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Estimating the costs of work-related accidents and ill-health: An analysis of European data sources

European Risk Observatory

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Table of Contents

List of figures and tables

Abstract

The European Agency for Safety and Health at work (EU-OSHA) aims to estimate the costs of accidents at work, work-related health problems and work-related deaths in Europe. The first step towards achieving this objective entails the production of an overview of the availability and quality of the national and international data sources required for the development of such a European-level cost calculation. The current report presents these results.

The availability of relevant data was checked at the international as well as the national level in the 28 Member States of the European Union (EU-28), Iceland and Norway. Data were collected with the assistance of country experts who were asked to complete forms relating to sources of cases and costs of accidents at work and work-related health problems.

The resulting data were assessed against predefined quality criteria. The cost assessment was limited to an overview of availability of data.

Having assessed the coverage and quality of the available data sources, it became apparent that there were insufficient data to determine cases of the work-related burden of disease at the European level. There is a paucity of robust, reliable data relating to accidents at work and work-related health problems.

With regard to costs, we found that direct healthcare costs can be deduced from international data sources. Calculating indirect costs, however, would be challenging, as data relating to several additional costs and the friction period are missing. Based on the available data sources on gross salary, we recommend adopting the human capital approach. An essential prerequisite for the use of such an approach, however, is that the number of missed work days can be estimated.

Despite the lack of data, some of the gaps may be filled through estimation. Suggestions for an approach to doing so can be based on the following observations:

- In some countries the availability of data sources appears to be reasonably sound and may be sufficient to carry out a cautious estimation. Subsequently, these results may be used to estimate the costs in other countries with comparable structures.
- Through a combination of figures on the work-related fraction of diseases, incidence and prevalence of these diseases, and costs associated with such diseases, a cost estimation may be feasible for some specific work-related diseases.
- Since much research has been done on the impact of certain risk factors on specific health problems, and figures on the occurrence of certain risk factors are also available, a cost estimation by risk factor seems feasible.

An approach like this may allow a partial cost estimation. However, an estimate of the **total** burden of work-related disease would require a considerable number of assumptions to be made.

List of abbreviations

ACSH	Advisory Committee on Safety and Health at Work
COPD	Chronic obstructive pulmonary disease
DALY	Disability-adjusted life-year
EEA	European Economic Area
EODS	European Occupational Diseases Statistics
ESAW	European Statistics on Accidents at Work
EU-28	28 Member States of the European Union
EU-OSHA	European Agency for Safety and Health at Work
Eurofound	European Foundation for the Improvement of Living and Working Conditions
Eurostat	European Union Statistical Office
EWCS	European Working Conditions Survey
GBD	Global burden of disease
GDP	Gross domestic product
HFA-DB	(European) Health For All Database
IHME	Institute for Health Metrics and Evaluation
ILO	International Labour Organization
JHAQ	Joint Health Accounts Questionnaire
KOOP	Kooperationsstelle Hamburg
LCS	Labour Cost Survey
LFS-AHM	Labour Force Survey Ad Hoc Modules
Modernet	Monitoring Occupational Diseases and tracing New and Emerging Risks in a NETwork
MSD	Musculoskeletal disease
NACE	Nomenclature statistique des Activités économiques dans la Communauté Européenne
NDPHS	Northern Dimension Partnership in Public Health and Social Wellbeing
OECD	Organisation for Economic Co-operation and Development
OSH	Occupational safety and health
QALY	Quality-adjusted life-year
SHA	System of Health Accounts
SME	Small and medium-sized enterprise
SOCX	Social Expenditure Database
TNO	Toegepast Natuurwetenschappelijk Onderzoek, Dutch organisation for applied research
VVA	Valdani Vicari & Associati
WHO	World Health Organization

Executive summary

Although many countries realise the importance of occupational safety and health (OSH), many workers still face unhealthy and unsafe working conditions (International Labour Organization, 2011). In 2013, there were approximately 3.1 million non-fatal accidents with at least four days of absence and 3,674 fatal accidents in the 28 Member States of the European Union (EU-28) (Eurostat, 2016a). In the same year, the percentage of the EU-28 population suffering from one or more work-related health problems, caused or made worse by work, was on average 7.4 % (Agilis, 2015).

A healthy and safe work environment not only is desirable from the workers' perspective, but also contributes considerably to labour productivity and promotes economic growth. OSH increases the competitiveness and productivity of enterprises by reducing costs resulting from accidents at work and work-related health problems, and by enhancing worker motivation. Moreover, a decrease in accidents and work-related health problems relieves pressure on public and private social protection, insurance and pension systems.

The European Agency for Safety and Health at Work (EU-OSHA) aims to estimate the costs of accidents at work, work-related health problems and work-related deaths in Europe. EU-OSHA will take a two-step approach to achieve this objective. The first stage entails the production of an overview of the availability and quality of national and international data sources required for the development of such a European-level cost calculation. The current report presents these results.

To estimate the costs of the work-related burden of disease, it will be necessary to estimate the number of cases of work-related ill-health, and subsequently apply monetary values to the identified cases. The availability of relevant data was checked at the international as well as the national level in the EU-28, Iceland and Norway. Data were collected with the assistance of country experts through the use of standardised templates. To ensure that these templates captured all relevant information, we conducted a literature search before the structure of the template was finalised. In this literature search, existing studies on costs of accidents and work-related health problems were reviewed. Moreover, we generated country profiles to identify the national structures that determine the reporting of accidents and work-related or occupational diseases, and to identify relevant characteristics for cost estimations. These profiles enabled a better understanding of the availability and quality of the data identified throughout the project.

The case template should cover every category of work-related ill-health. Cases include accidents at work and other health problems which are (partly) caused or aggravated by work. Health problems in which the occupational factor is the only or the most important cause are also identified as 'occupational diseases'. We identified four main categories:

- accidents at work;
- occupational diseases;
- work-related diseases; and
- presenteeism.

For each category, the template contained questions about the source of the information, geographical scope, type of time frame (e.g. single study, continuous registration), accessibility, disaggregation potential (by age, gender, economic sector, occupation, type of employment or diagnosis) and coverage (e.g. sectors excluded, self-employed excluded). If applicable, information relating to the type of health problem and severity was collected as well as general reporting criteria, such as voluntary or obligatory reporting, incentives, and estimates of underreporting. Furthermore, the template contained specific information relating to the categories, for example, 'what is the definition of "accident"?'

To get an overview of the data sources available for the estimation of the costs of accidents at work, illnesses, deaths and presenteeism, we used a template to collect information on the following cost categories:

- productivity costs;
- healthcare costs;
- quality-of-life losses;

- administration costs; and
- insurance costs.

To enable the completion and interpretation of the costs template, the cost categories were subdivided into subcategories by cost bearer. Cost bearers may be:

- workers and family;
- employers;
- the government; and
- society.

Similarly to the case template, each (sub)category contained extra information on source, geographical scope, type of time frame (e.g. single study, continuous registration), accessibility, disaggregation potential (by age, gender, economic sector, occupation, type of employment or diagnosis) and coverage (e.g. sectors excluded, self-employed excluded). Furthermore, the experts were invited to add comments on methodological approach and study quality.

To assess the quality of data sources on **cases**, the following quality criteria were used:

- data sources available on fatal as well as non-fatal accidents at work (only for accidents at work);
- no explicit bias in the survey (representative of the population, no extremely low response rates, or other limitations) or registration (not voluntary, no reports of underreporting);
- universal coverage (i.e. no sectors or occupations excluded, self-employed included);
- latest year of availability after 2005.

A three-point quality score system was used to assess the data. A score of 2 was assigned if all quality criteria were met, 1 if one or more of the criteria were not met, and 0 if no data were available.

The assignment of quality scores was not possible for cost data sources as cost categories were often based on a variety of data sources, and information concerning quality was often lacking. Therefore, this overview of data sources on costs will be limited to the availability of the data. To assess the coverage of data sources on costs, we first identified the cost types that were considered the most essential for our aim, which resulted in the following direct and indirect cost types:

- healthcare costs within the healthcare system: overall health spending and overall medical costs for workers in disability schemes;
- productivity costs: gross salary, number of working days lost, friction period[1], overall costs of sick pay/sickness benefits, overall costs of incapacity/disability benefits;
- additional costs not covered by the two previous categories: the costs of temporary worker replacement, recruitment costs and rehabilitation costs.

In addition to these costs we also estimated the costs of the impact of work-related health losses on life. These costs refer to the value of loss in quality of life or to the loss of life itself. It is not possible to assign a monetary value to this loss directly. However, by assigning a value to the loss of quality of life, it ensures that the impact of work-related illness on quality-of-life loss is considered when making decisions on OSH. When included in cost estimates, quality of life is often the largest component.

After the assessment of coverage and quality of the data sources needed, we came to the following conclusions:

- With regard to accidents at work, in the international data sources [European Statistics on Accidents at Work (ESAW) and Labour Force Survey ad hoc modules (LFS-AHM)] many countries have missing or unreliable data for non-fatal accidents. In some countries, national sources are available that may complete or replace the international data sources; however, we cannot be sure of their quality.

[1] The friction period is the time needed until another worker from the pool of unemployed has fully replaced the individual who is absent due to illness (W. Kirch, 2008, Encyclopedia of Public Health, Springer)

- In addition to accidents at work, the occurrence of occupational diseases, defined as illnesses caused by work, is an important indicator for the work-related burden of disease. However, the debate on what diseases are caused by work and what diseases have another origin is not yet over. European countries apply different lists of occupational diseases and diagnostic criteria.
- Data are available on work-related health problems for all European countries in the present study. Although the data originate from sound international sources (surveys of high quality), the value of self-reported work-related health problems for estimating the work-related burden of disease is limited. Apart from the general limitations of international surveys, such as recall bias, wording problems and cultural differences, the main limitation is the inability to assess fatal diseases and diseases with a long latency using a survey. Further only one disease per year is taken into account, even if further incidents of ill-health occurred, which can lead to underestimation of the real problem.
- Data on presenteeism, derived from a high-quality survey, were obtained for all countries. However, this information is not sufficient to estimate the productivity and output losses or any other costs due to presenteeism as no information is available on work-relatedness or the extent of productivity loss.
- We have data on the prevalence and incidence of diseases for all countries. However, to assess the work-related burden of disease, we still need to know the work-related fraction of these diseases.

In summary, there were insufficient data to identify cases of the work-related disease at the European level. There is a paucity of robust, reliable data relating to accidents at work and work-related health problems.

Although data on cases are missing, we identified sources on costs:

- The majority of countries provided data sources on overall health spending and overall medical costs for workers in disability schemes. To place the actual magnitude of healthcare costs in perspective, data on productivity costs and loss of quality of life are of great importance.
- With regard to productivity costs, international data sources provided data only on gross salary. National data on the number of working days lost, friction period, overall costs of sick pay/sickness benefits and overall costs of incapacity/disability benefits are fragmented, making the calculation of productivity costs challenging. The human capital approach (see section 4.2.3) seems the most appropriate means of calculating the cost of poor OSH practices, but this approach still requires the estimation of the number of work days.
- Data on additional costs — mainly used for the friction cost approach — are rare. Therefore, extra costs of replacing a sick worker and reaching the initial productivity level cannot be calculated.
- With regard to the quality-of-life losses, almost no data are available on quality-adjusted life-years or willingness to pay. An alternative may be found in the disability-adjusted life-year (DALY), provided by the Global Burden of Disease study. The work-related fraction is required to calculate the number of DALYs associated with accidents at work and work-related illness.

In summary, direct healthcare costs can be deduced from international data sources. However, calculating indirect costs is challenging, as several additional costs and costs on the friction period are missing. Based on the available data sources on gross salary, we recommend adopting the human capital approach. However, to use this approach, estimation of the number of work days missed is essential.

Despite the lack of data, some of the gaps may be filled through estimation. Below we list some possibilities.

- In some countries the availability of data sources appears to be reasonably sound and complete and may be sufficient to carry out a cautious estimation. Subsequently, these results may be used to estimate the costs in other countries with comparable structures.
- Through a combination of figures on the work-related fraction of diseases, incidence and prevalence of these diseases and costs associated with such diseases, a cost estimation may be feasible for some specific work-related diseases.
- Since much research has been done on the impact of certain risk factors on specific health problems, and figures on the occurrence of certain risk factors are also available, a cost estimation by risk factor seems feasible.

These methods may allow a partial cost estimation. However, an estimate of the **total** burden of work-related disease would require a considerable number of assumptions to be made.

Development of an approximate economic costing model

Given the limitations of national data sources discussed in this report, EU-OSHA will collaborate with the ILO, Finland and Singapore in the development of an approximate cost estimate, based on available data at international level, to calculate a rough cost estimation for each EU member state including Norway and Iceland. The calculation will be based on DALYs (disability adjusted life years) lost due to occupational injuries and work-related diseases. It is planned to present this estimate together with the ILO at the XXI World Congress on Safety and Health at Work in Singapore in September 2017.

1 Introduction

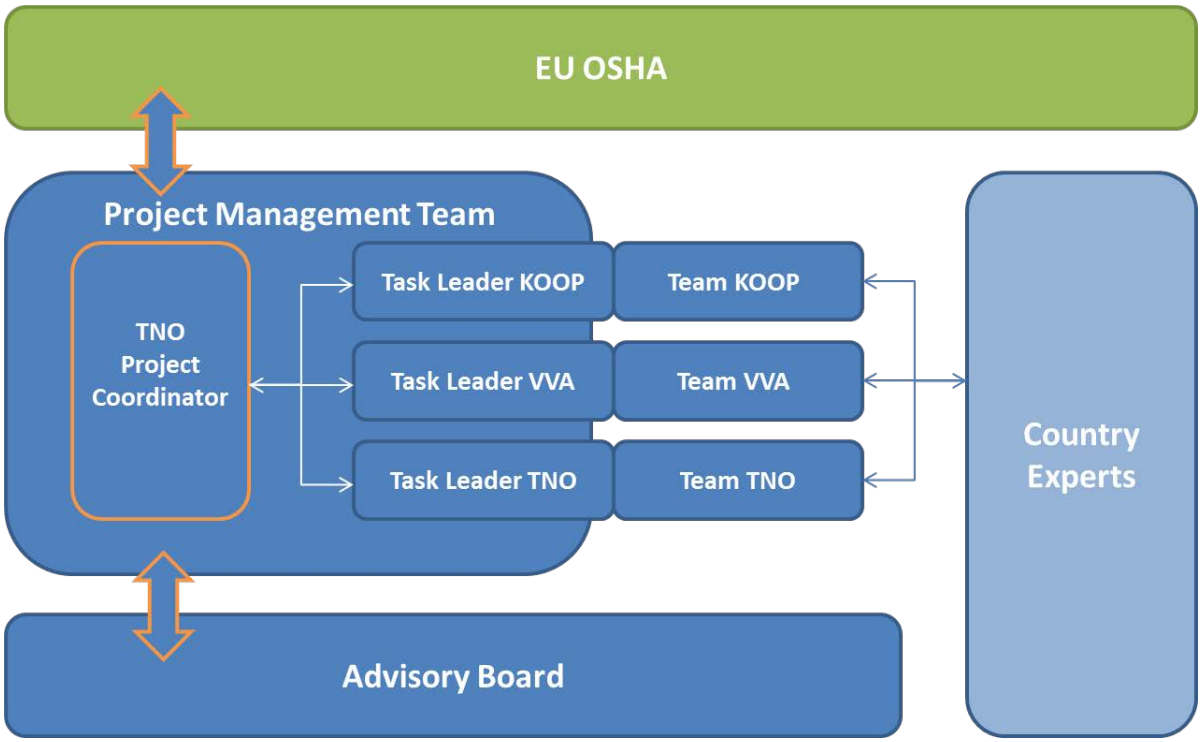
The European Agency for Safety and Health at Work (EU-OSHA) aims to improve information on costs and benefits of occupational safety and health (OSH) practices to (1) understand the rationale behind the different cost estimates and (2) to provide policy-makers with relevant information on the economic impact of poor or non-existent OSH practices at the macro level.

With these aims in mind, the objective of this study is to contribute to an estimation of the costs of work-related injuries, illnesses and deaths at the European level. Specifically, the study corresponds to the first step in a two-stage approach to cost estimation adopted by EU-OSHA:

1. production of an overview of availability and quality of national and international data sources that can be used to develop a cost calculation of work-related injuries, illnesses and deaths at a European level;
2. development of a European costing model of work-related injury and illness.

To undertake this study, a project team was formed consisting of employees from three organisations: TNO (Toegepast Natuurwetenschappelijk Onderzoek), KOOP (Kooperationsstelle Hamburg) and VVA (Valdani Vicari & Associati). As shown in Figure 1 the team worked in close cooperation with EU-OSHA and installed an independent advisory board of five international experts who provided feedback throughout the project. The collection of the data was done by subcontracting country experts from the 28 EU Member States (EU-28), Norway and Iceland.

Figure 1: Project organisation.



The study itself was divided into four tasks. An overview of the tasks and corresponding main activities is provided in Table 1.

Table 1: Overview of tasks and main activities

Task	Main activities
1. Identification of data sources	Literature review Template development
2. In-depth description of the data sources	General characterisation Availability of data sources
3. Quality assessment and visualisation of data sources	Quality assessment Tool development for visualisation
4. Discussion of findings	National and European data sources Overall discussion Recommendations

This report presents the results of the study and is structured as follows:

- Chapter 2 provides insight into the nature of the problem of absent OSH, trends in OSH behaviour and the content of OSH in workplaces.
- Chapter 3 presents the methodology used for identifying national and international data sources on cases and costs relevant to the development of a cost calculation model.
- Chapter 4 describes and visualises the quality of the data.
- Chapter 5 discusses the results and provides recommendations.

2 Background

This section provides insight into the key issues surrounding the problem of poor or non-existent OSH practices.

2.1 Problem size

Together we strive for a world with fewer accidents and work-related illnesses and health and safety is regarded as a basic human right by the International Labour Organization (ILO)[2]. Creating a safe and hazard-free environment might contribute to better mental and physical well-being of workers and higher productivity, and ultimately enhance the competitiveness of businesses. Further development of OSH policies and optimising existing measures are essential in realising a safe and healthy workplace. Insight into the financial consequences of work-related accidents and illnesses provides EU-OSHA, governments and employers' organisations with relevant data for the purpose of developing OSH policies and agreements.

According to the ILO, work-related diseases cause the death of 2 million workers worldwide annually, with another 350,000 fatalities caused by accidents at work (International Labour Organization, 2014). In total, this amounts to approximately 6,300 occupational fatalities per day. In addition, there were also 313 million non-fatal accidents requiring at least four days of absence from work, resulting in ill-health for 860,000 workers every day (International Labour Organization, 2011). These figures highlight the need for preventative measures.

At the European level these figures are also remarkably high. In 2013, approximately 3.1 million non-fatal accidents requiring at least four days of absence from work and 3,674 fatal accidents were reported in EU Member States (Eurostat, 2016a). In general, men are more likely to have an accident at work than women. This is probably a result of the composition of the workforce in different sectors and occupations. At the Member State level a severe underreporting of non-fatal work injuries in several countries can be observerd Kurppa, K. (2015) and also the incidence of fatal accidents varies. In 2013, incidence rates per 100,000 workers ranged from 1.0 or less in Sweden, Greece, the United Kingdom (UK) and the Netherlands to over 4.0 in Latvia, Malta, Portugal and Lithuania. With regard to reported non-fatal accidents, incidence rates range from less than 100 per 100,000 persons employed in Bulgaria and Romania to over 3,000 per 100,000 in France (Agilis, 2015). In addition to these accident rates, 7.4 % of the workforce suffered from work-related health problems. In all countries, except for the United Kingdom, musculoskeletal disorders were the most important work-related health problem reported. In the UK stress, depression and anxiety were the most frequently reported work-related health problems (Agilis, 2015). These figures should be interpreted cautiously, the European Union Statistical Office (Eurostat) have highlighted that there is a degree of uncertainty associated with self-reported questionnaires, as e.g in the Labour Force Survey, LFS (Eurostat, 2015b).

Accidents at work were more prevalent among workers employed in the construction and industry sectors. Moreover, 'skilled agricultural workers; forestry and fishery workers; craft and related trades workers; and plant and machine operators/assemblers' were reported to be more likely to have an occupational accident (Agilis, 2015). One of the most important risk factors for the onset of work-related diseases is the exposure to hazardous substances. The exposure to occupational carcinogens, for example, resulted in an estimated 1.6 million disability-adjusted life-years (DALYs; one DALY is one lost year of 'healthy' life) and approximately 152,000 deaths. In 2005 in the UK, 8,010 cancer deaths and 13,598 cancer registrations were attributable to occupation (Rushton et al., 2010).

Workers employed in small and medium-sized enterprises (SMEs) are particularly vulnerable to occupational hazards. They are more likely to experience poorer working conditions and lower job quality, which results in greater risks (EU-OSHA, 2016). In total, 7.4 % of European workers suffered from work-related health problems. The most frequently reported health problems were musculoskeletal disorders, stress, depression and anxiety (Agilis, 2015).

[2] http://www.ilo.org/public/portugue/region/eurpro/lisbon/pdf/28abril_09_en.pdf

Work-related accidents and illnesses have far-reaching consequences at the individual, employer and societal levels. For individuals, these come in the form of a deteriorating financial position, social isolation and dwindling career prospects. Socially, costs are high because of the risk of long-term benefit dependency, early retirement and (permanent) loss of production for companies. This ultimately results in an increased pressure on the social security systems. In 2011, the Organisation for Economic Co-operation and Development (OECD) countries spent roughly 2.1 % of gross domestic product (GDP) on work-related incapacity benefits (OECD, retrieved November 2016a). However, a large proportion of these costs are preventable through the implementation of OSH measures. The ILO estimates that 4 % of global GDP is spent on dealing with work-related accidents and illnesses (Takala et al., 2014). This percentage may vary widely between countries (in particular between western and non-western countries and depending on the working conditions in the country). At the national level, the UK estimates the financial impact of workplace injuries and illnesses to amount to GBP 14 billion (16.47 billion Euro 16/02/17), which is 0.8 % of the GDP (Health and Safety Executive, 2011). In the Netherlands, direct medical costs (EUR 76 million) and absenteeism (EUR 200 million) are estimated to amount to EUR 276 million (Bakhuys Roozeboom et al., 2011). A more detailed review of several national estimations is given in the EU-OSHA (2014) report on 'Estimating the costs of accidents and ill-health at work — A review of methodologies'.

Based on these estimates the magnitude of insufficient safety and health practices in workplaces becomes clear. Adequate policy aimed at reducing work-related accidents and illnesses is of great importance, not only in financial terms, but also because of the need to increase sustainable employability of workers and to promote the competitiveness of European companies.

3 Identification of data sources: methodology and results

The first step towards the development of a European costing model of work-related injuries, illnesses and deaths was to compile an overview of the availability, quality and comparability of national and international data sources. As we expected many differences in reporting of surveys and statistics across countries, we developed two templates to facilitate comparison of the national data sources in terms of availability and quality of data. This chapter describes the reasoning behind the templates and the development process used. We distinguished two levels of the data, each of which is reflected in one of the templates:

- the number of cases (the occurrence and the duration of accidents and incidents related to ill-health at work); and
- the costs that result from ill-health at work.

The development of the 'cases' and 'costs' templates followed a similar approach and was linked to capture as many aspects as possible that are sufficiently harmonised to facilitate the collection of information by national experts.

The templates were used to collect information at the international level by the project team. The data at national level were collected from 30 qualified country experts (EU-28, Norway and Iceland, selected in consultation with EU-OSHA).

3.1 Template development: cases

The objective of the development of the cases template was to identify the relevant data sources at the national and European level (availability) and to gather information about the data collection methods and the metadata used (quality of the data). A second goal of this exercise was to be able to compare the aforementioned data sources and to draw conclusions from similarities and differences in data collection.

3.1.1 Categories

For the template on cases, every category of work-related ill-health had to be taken into consideration. Therefore, work-related accidents and injuries, illnesses and deaths, but also other reasons for not being able to work or for not being able to work at full capacity because of ill-health (e.g. presenteeism) needed to be included and quantified.

We identified four main categories, which will be presented concisely in this section together with an overview of potential issues relating to the availability, quality and comparability of such data sources in general. These gave rise to the decisions we took with regard to the development of the templates (described in section 3.1.2). The categories of work-related ill-health are:

- accidents and injuries at work;
- occupational diseases;
- work-related diseases; and
- presenteeism.

The reporting characteristics used for the development of the templates were identified by analysing previous studies on work-related ill-health reported at the national, European and international levels, and the respective methodological approaches.

Accidents at work

Concepts and definition

Definitions of accidents at work differ among countries and among data sources. Therefore, in the template the country specific definition was asked. The template contained criteria for including or excluding categories of accidents, such as traffic accidents (while at work or during commuting), accidents on business trips, accidents caused by negligent behaviour of the worker or by third parties, accidents during breaks and excluded workplaces or work situations.

Coverage

The reporting criteria for occupational injuries provided by the ILO (International Labour Office, 2010) identify additional sources for potential reporting differences, such as the possible exclusion of reported cases because of economic sector, employment type, duration of absence.

The coverage of economic sectors and workers differs across countries. Sectors that are often not included in the statistics are the military, certain (or all) public services, agriculture, mining, aviation, seafarers and off-shore services. Persons who are typically not included are the self-employed, family helpers, voluntary workers, students, trainees/interns, migrant workers or employees of foreign members, companies and expatriates. Another easily overlooked category is workers in precarious and vulnerable situations, who are not part of the formal economy. These workers have a higher risk of injury, as they are often employed in high-risk jobs, with little or no social protection. In addition, there are countries that do not record accidents experienced by part-time workers or short-term contractors. Depending on the total number of workers and sectors included, national statistics may suffer from undercoverage in relation to the overall workforce.

Because of their cross-cutting nature, the abovementioned aspects related to coverage also apply to the other categories of work-related ill-health: occupational diseases, work-related diseases and presenteeism.

Quality assessment

Several studies have already explored the data quality in work-related statistics (e.g. Saloniemi and Oksanen, 1998; Loomis et al., 2004; Spreeuwers et al., 2010). Our starting point for the identification of methodological differences in relation to cases of accidents at work was a study by Kurppa (2015). He looked at available data from the ILO Laborstat database for the year 2008. He found differences not only in data availability, data provider and type of data source, but also in the quality of data (coverage, minimum period of lost work days, economic activities covered, commuting accidents included or not) and disaggregation of the data.

This demonstrates that the comparability of data sources can be compromised by differences in reporting. For example, in many countries accidents causing up to three days of absence are not reported; only accidents at work requiring more than three days of absence are reported to the authorities and/or insurance companies. In addition, the day of the accident may or may not be included in counting the days of absence. The three-day criterion is often considered alongside a criterion on the severity of the accident. When considering the full cost of accidents at work, the costs of short-term absence, when the worker stays home for one or two days, should also be included. This kind of analysis requires extrapolation from data sources that provide data on short-term absences.

Cases of early retirement and fatalities due to accidents at work are usually reported. However, further criteria that consider the results of medical examinations may apply. In the context of absences, in some countries absences are reported only up to a maximum number of absence days; this may correlate with the maximum number of days that are compensated. In the context of early retirements and fatalities, Member States have developed different criteria for establishing a causal link between accidents and long-term consequences.

Kurppa further points out the importance of the reporting system, notably insurance-based and non-insurance-based systems. The rationale behind this is that insurance-based systems provide a financial incentive to report accidents at work, while legal obligations of employers in non-insurance-based systems to report accidents to national authorities are not always followed and thus lead to underreporting.

Occupational diseases

Concepts and definition

In the EU context, an occupational disease is defined as 'a case recognized by the national authorities responsible for recognition of occupational diseases. The data shall be collected for incident occupational diseases and deaths due to occupational disease' ([3]). In many cases, occupational diseases have a strong relation to one or several occupations and often have one specific causal agent.

Coverage

See above (under 'Coverage' in subsection 'Accidents at work').

Quality assessment

In practice, at the national level the recognition of occupational diseases is affected by the national culture of occupational medicine, dominance of certain sectors or occupations, and judicial and administrative considerations. Together, these factors result in large differences in reporting and recognition [for the example of musculoskeletal disorders (MSDs), see (Eurogip, 2006; EU-OSHA, 2010)]. This leads to the situation that the number of recognised occupational diseases does not reflect the overall burden of disease experienced.

Work-related diseases

Concepts and definition

Work-related diseases are defined as follows: 'Work-related health problems and illnesses are those health problems and illnesses which can be caused, worsened or jointly caused by working conditions'[4]. It does not necessarily refer to recognition by an authority.

Quality assessment

Work-related diseases may have multiple causal agents; factors in the working environment may play a role (Nagy and Kudasz, 2016)). To get the full picture of the magnitude of work-related illness — and not only those that are accepted by the national compensation systems — it is necessary to include general health statistics and surveys that extract the work-related proportion of the overall diagnoses. This particularly concerns MSDs and psychosocial disorders. Despite not being accepted as occupational in many Member States, MSDs and psychosocial disorders are responsible for a great number of cases of long-term absence and early retirement; medical costs represent a major expense for companies, social systems and society.

Presenteeism

Concepts and definition

Another consequence of work-related ill-health is presenteeism, which in this context is most commonly understood as working while being sick or as the productivity losses resulting from working while being sick (Goetzel et al., 2004), in contrast to sickness absenteeism, which can be generally defined as not going to work as scheduled because of health issues.

Quality assessment

Several definitions of presenteeism are used across studies (Steinke and Badura, 2011). Their scope can be narrower, wider or just different from each other. Studies have shown that productivity losses stemming from presenteeism may be even higher than from sickness absence (Goetzel et al., 2004). The work-relatedness of presenteeism lies in the presence at work despite being ill, and not necessarily in the work-relatedness of the health issue. However, since presenteeism is connected with productivity and output losses and with future ill-health, it is important to include presenteeism in the development of the costing model.

([3]) Annex V of Regulation (EC) 1338/2008.

[4] https://oshwiki.eu/wiki/Introduction_to_occupational_diseases

As there are no national data sources/statistics on presenteeism and its health consequences, the template development focused on differences in the definitions of presenteeism used in various surveys. There is much room for different approaches in reporting presenteeism, which makes it even more difficult to report on than absenteeism. We used several definitions of presenteeism that were identified by Johns (2010) and included them in the template, asking the national experts if one of those definitions was used or to describe the alternative definition.

3.1.2 Template structure

The final structure of the cases template reflects, as much as possible, the considerations highlighted in section 3.1.1. The structure of the collection of data sources and their respective metadata for the cost template was matched as closely as possible. For example, table 2 provides a schematic overview of the information that was collected about work-related diseases using the template.

Table 2: Schematic overview of the information collected (example: work-related diseases)

Category	**Requested information**		
< Accidents			
> Work-related diseases			
< Occupational diseases			
< Presenteeism			
Source information	Source name	Published by	Web link
	Type of source	Data collected by	–
Reference information	Reference period	Latest publishing date	Time series availability
	Geographical coverage	–	–
Availability	Publicly available	Available online	Available free of charge
	Other availability information	–	–
Disaggregation potential	Age group	Gender	Economic sector
	Occupation	Type of employment	Diagnosis
Coding	ICD coding/other coding	ISCO-08/other coding	Coding of economic sectors
Sectoral and personal coverage	Economic sectors excluded	Occupations excluded	Self-employed covered
	Family helpers covered	Volunteers covered	Trainees/apprentices/interns covered
	Students/pupils covered	Migrant workers/non-resident workers covered	Expatriates covered
	Further workers not covered	Further exclusion criteria	Estimation of undercoverage
Reporting of cases	Total number of persons covered	Number of cases in reference period (incidence)	Incidence rate
	Unit used for reporting incident rate reporting	Prevalence	–
Diseases attributable to work	Attributable risk method applies	Other method applies	Further (limiting) causation criteria
Absence days calculation	Minimum of (full) days absent	First day included	Part-time absence possible?

Category < Accidents > Work-related diseases < Occupational diseases < Presenteeism	Requested information		
	Work days only/calendar days	–	–
Severity of diseases	Average absence (days) per case	Total number of work days lost	Number of early retirements resulting from the disease
	Partial retirement due to work-related diseases?	Number of partial pensions	Job changes (injured workers forced to change job)
Other severity criteria	Further consequences reported	Number of fatal work-related diseases	–
Severity reporting criteria	Maximum number of days between first day of illness and consequence	Further limiting causation criteria for severe diseases (especially leading to retirements and fatalities)	Limit of duration of absence
	Other	–	–
General reporting criteria	Reporting voluntary/obligatory	Who reports	To whom
	Receiving institution = publishing institution	Incentives for reporting	Estimation of underreporting

For each category (accidents at work, occupational diseases, work-related health problems and presenteeism) a separate worksheet was available in the template. Part of the information collected about the data sources was generic and the rest was specific (i.e. focusing on the differences in concepts/definition, reporting differences and other methodological information considered relevant for the respective category).

Generic information about the data sources

For each sheet and data source, meta-information about the source was sought, e.g. the source information (name, publishing institution, publication date), the geographical scope and time frame of the data (single study or recurring survey), and information concerning the availability of the data to the public/scientific public. This information is needed for assessing the accessibility of the data source and the extent of reporting of the source, thus providing information about the future usability for the development of the costing model.

The information relating to the disaggregation potential of the data (e.g. by age, gender, economic sector, occupation, type of employment or diagnosis), the coding system of economic sectors and occupations, and information relating to sectoral and personal coverage, are the meta-information of the data used by the data source. This kind of information is relevant because it displays the variety in reporting of data that would otherwise appear to be the same. For example when certain groups are excluded, when only cases of a certain severity are reported, when there is an incentive to report or not: all these factors can substantially influence the number of cases reported. Furthermore, when different codes for sectors or occupations are used, the possibility of extrapolating data from one data source using another is compromised.

Specific information relating to the categories

The section of the template on specific issues asked for information on the general reporting criteria, on to the data source for the concepts and basic definitions relevant to the category, on the type and quality of data that are delivered on the category and on severity criteria. This type of information is relevant for comparisons between different sources and among national sources.

3.2 Template development: costs

The objective of this task was to identify national and international data sources in order to estimate the costs of work-related accidents, illnesses, deaths and presenteeism. Sections 3.2.1 and 3.2.2 describe the process of template development in more detail.

3.2.1 Categories

To avoid duplicating previous research, this step drew on the review of methodologies for estimating the cost of accidents and ill-health at work carried out by TNO and Matrix for EU-OSHA (de Weerd et al., 2014; EU-OSHA, 2014). Existing research on costs of accidents and ill-health at work was reviewed and a set of studies that aimed to estimate these costs were identified.

A set of studies that covered a range of industries or injuries/illnesses and were of sufficient methodological quality was shortlisted. The shortlisted studies were:

- Ayres et al. (2011);
- Béjean and Sultan-Taïeb (2005);
- Biddle (2004);
- Boonen et al. (2002);
- Health and Safety Executive (2011);
- Koningsveld et al. (2003);
- Leigh et al. (2001);
- Rikhardsson (2004);
- Romero and Romero (2010);
- Safe Work Australia (2012).

This shortlist of studies was then used as a basis for identifying the cost types and data needs involving:

- identification of major categories of economic costs;
- description of key structures that determine costs;
- development of a template for cost data-extraction.

This step drew on the 2014 study for EU-OSHA on the methodologies for estimating the cost of accidents and ill-health at work (de Weerd et al., 2014), with the present study using the typology developed by TNO and Matrix.

Furthermore, the above cost categories can apply to the following stakeholders (i.e. the groups bearing the costs):

- workers and family;
- employers;
- government and society.

3.2.2 Data requirements and template structure

The next step in the template development process related to identifying the costs data required. This involved a review of the methodological approach of each shortlisted study and identification of the data needed to estimate costs in each study. Just as for the cases template, the data required were identified primarily on the basis of the TNO–Matrix report (de Weerd et al., 2014). Original sources were consulted directly only where relevant.

To identify data requirements, a matrix was set up detailing the types of costs and the groups bearing the costs. The output of the exercise was a long list of data requirements for each of the shortlisted studies, categorised using the typology outlined in section 3.2.1. This was followed by the cleaning and structuring of the long list of data requirements. This involved:

- removing duplicates (i.e. in situations where multiple studies used the same type of data);
- removing data categories from the list that did not directly relate to costs;
- ensuring consistent wording and definitions (i.e. where different studies used the same type of data but defined or named it differently — for instance 'gross wages per hour' and 'gross monthly income' would be considered part of a single category of 'gross salary').

The cost data collection template was structured according to the data matrix of the cases and was thus divided into separate sheets for each of the cost categories (productivity costs; healthcare costs; quality-of-life losses; administration costs; and insurance costs), with each individual sheet divided into costs for the four stakeholder groups (cost bearers). The requested information was of the same type as was requested for the cases template, except that it was requested for each source. Table 3**Error! Reference source not found.** provides a schematic representation of the costs template relating to productivity costs only. The template itself contained guidance and definitions to facilitate collection of the information.

Table 3: Schematic overview of the structure used in the costs template (the example pertains to productivity costs)

Cost type	**Requested information**						
> Productivity costs	**Source details**	**Source type**	**Availability**	**Unit of measurement**	**Disaggregation potential**	**Methodological approach**	**Sectoral and personal coverage**
< Healthcare costs							
< Quality-of-life losses							
< Administration costs							
< Insurance costs							
Cost bearer							
Productivity costs for workers and family							
Gross salary/gross earnings							
Salary evolution over time/with experience							
Employer contribution to retirement fund							
Employer contribution to life insurance							
Employer contribution to medical benefits							
Total value of employer funded fringe benefits							
Value of statutory sick pay/sickness benefits							
Value of statutory disability/incapacity benefits							
Value of home production							
Value of workers' compensation							
Productivity costs for employers							
Friction period (period until a new worker is hired)							
Decrease in productivity due to evacuations, clean-up, transport and preventive activities							

Cost type	Requested information
Decrease in productivity due to machine damage	
Decrease in productivity due to presenteeism	
Gross salary of managers	
Gross salary of the personnel involved in investigating, disclosing, discussing and preventing the incident or accident	
Time taken for managers to redistribute work	
Time taken to investigate accidents	
Cost of material and components used or lost	
Cost of national insurance contributions	
Cost of sick pay/sickness benefit contributions	
Cost of contributions to private disability insurance and other private insurance schemes	
Cost of temporary worker replacement	
Recruitment costs	
Rehabilitation costs	
Value of government reimbursement	
Productivity costs for the government	
Overall cost of sick pay/sickness benefits	
Overall cost of incapacity/disability benefits	
Overall cost of social welfare programmes	
Productivity costs support data	
Discount rate	
GDP	
Economic growth rate	
Long-term economic growth rate	
Income tax	
Inflation level	
Life expectancy	
Population	
Effective retirement age	

3.3 Harmonisation of the templates

A preliminary version of the templates and guidance report was reviewed and commented on by the project Advisory Board. This yielded helpful comments and further insights in the issue of reporting differences and underreporting in relation to accidents at the workplace across EU and European Economic Area (EEA) Member States.

The project team intended to use the same structure for the two templates in order to simplify their completion by the national experts. However, this was not possible because the sources used were so

diverse in nature: the template for the cases asked for information stemming from a few sources with diverse quality of reporting within the source, whereas the template for the costs asked for information stemming from numerous sources. Wording and structure were harmonised as much as possible.

As a pre-test, the templates were also filled out by project team members who had not been involved in the template development. This way we received insights into the usability of the templates and on ambiguous requirements. The team decided to indicate (grey out) cells that were not applicable in the context of specific information requirements.

The templates and guidance document for the templates were finalised after we received feedback from EU-OSHA and the members of the Advisory Board. The Advisory Board agreed with the final draft templates and made minor corrections and proposals on specific items. In one case an overlap between the templates and their categories was highlighted. The board members also provided several comments on terms, definitions and practical experience when working with such data. These comments helped to further elaborate the guidance notes.

3.4 Data collection with the templates

Having processed all feedback from EU-OSHA and the Advisory Board, we sent out the final versions of the templates and guidance documents to country experts at the beginning of January 2016.

To facilitate the completion of the templates by the national experts, and to ensure that information was standardised, additional information and instructions were added to the templates. Moreover, contact persons were provided for the experts to whom questions could be addressed if problems were encountered during the completion of the templates.

The guidance documents were considered helpful for the national experts when filling in the templates, and also harmonised the completion of the templates.

3.5 Country profiles

The objective of the country profiles was to identify the national structures that determine the reporting of accidents, diseases, deaths and presenteeism, as well as the costs of work-related injuries, illnesses and deaths in individual countries, and any characteristics relevant to cost estimations. These documents accompany the data gathered on costs and cases; they also enable a better understanding of the availability and quality of the data identified throughout the project. In particular, the following key aspects are included in the country profiles:

Key aspects of OSH

- Type of registration system for work-related accidents and diseases
- Relevant legislation concerning OSH and worker compensation
- Key characteristics of the insurance systems
- Elements of the social protection systems of relevance to worker compensation, remuneration and OSH
- Remuneration and compensation structures (including relevant elements of the tax and/or insurance systems)
- Healthcare and health insurance systems, in particular with regard to estimation of treatment costs and groups bearing these costs

These themes are complex and it is important to note that significant variation can be observed at the national level in terms of systems in place for dealing with OSH matters. As the purpose of the country profiles is to interpret and support the analysis of the data gathered, the focus was solely on national characteristics that directly influence the availability and quality of data sources. Factors that should contribute to reporting are the social system (insurance-based versus tax-based system), incentives connected to the reporting (the reporting is beneficial for either employer or employee), the reporting

authority (labour inspectorate versus insurance company) and whether reporting is obligatory or not. While cultural factors and traditions are also often thought to contribute to reporting about cases and costs, these more intangible factors could not be reliably measured in this study. Regarding cost registration, tax-based social systems may register cost drivers less accurately. Countries with an extensive private insurance system certain ly have a cost structure that is different from exclusively public systems.

Our starting point for the development of the country profiles was the OSH-wiki website[5], which includes country-specific pages for all EU Member States, as well as for Iceland and Norway. The information included on these pages has been developed and uploaded by experts at the national level and checked by EU-OSHA national focal points. The first step in the development of our country profiles was the consultation of each national expert both to ensure that the data available from the OSH wiki were up to date, and to check if there were any crucial modifications or amendments in the legislation that had taken place recently, or would take place in the near future, which would have an impact on data availability. The team also drew upon available comparative studies at the European and international levels, in particular reports published by EU-OSHA (EU-OSHA, 2010; EU-OSHA, 2013; EU-OSHA, 2016).

In addition to the aspects outlined on the OSH-wiki website, we included some key information regarding the health systems in place in the EU Member States, as this aspect is relevant to understanding the data on costs that have been collected throughout the project.

Additional information was collected on the responsibility for reporting accidents at work and occupational diseases, and how this information was transferred to the respective national datasets. Such information was drawn from websites of the national OSH institutes and from comparative studies or web portals on social systems provided by the European Commission (European Commission, 2016), professional service firms (PricewaterhouseCoopers (PwC), 2014) and the ILO (International Labour Organization, 2016). Further useful information for the Baltic countries could be retrieved from the websites of the Northern Dimension Partnership in Public Health and Social Wellbeing (NDPHS[6]) and the Norwegian Labour and Welfare Administration (Norwegian Labour and Welfare Administration, 2013).

The information contained in the country profiles can be used to analyse the templates along the following dimensions:

- the type of social security systems, i.e. Beveridge (tax financed) system versus Bismarck (insurance based) ([7]) versus other types of systems; implies several differences in reporting and in the costs induced by work-related ill-health;
- separate systems for work-related ill-health and non-work-related ill-health versus one system covering all issues of ill-health;
- private insurance sector with competition versus exclusive public/state-run accident insurance (and social welfare system);
- obligatory reporting versus voluntary reporting of accidents at work and occupational diseases;
- positive incentives in registration versus no incentive versus incentives for not reporting by the employee and/or the employer;
- single social authority (e.g. Baltic countries) versus two to four parallel systems (e.g. Germany).

The summary of the country profiles can be seen in Annex A.

([5]) https://oshwiki.eu/wiki/Main_Page
([6]) http://www.ndphs.org/
([7]) The differences between the types of security systems are not as black and white as they might seem (see, for example, http://www.oecd.org/governance/budgeting/49095378.pdf). However, we still included the distinction in our profiles, since it may offer valuable background information.

4 Quality assessment — methodology and results

4.1 Number of cases

4.1.1 Estimation of the number of cases

A crucial step in the estimation of the costs of work-related health loss is the estimation of the number of cases. At first glance, the estimation of work-related accidents seems straightforward. Most countries use similar definitions of a work-related accident and have a registration system in place to record the occurrence of these accidents. However, problems arise as registration systems differ regarding underreporting and coverage between countries depending on the compensation system in place and on the way the registration is organised. Apart from registration systems, self-reported data on accidents are available through surveys, but obviously these responses do not cover fatal accidents.

The estimation of occupational or work-related diseases is even more complicated. One major difficulty is that many diseases have multiple origins and proving work-relatedness can be difficult. In some surveys, respondents are asked if their illness is partly caused by their work. However, it is questionable if these persons are able to judge the link to work. Many scientific studies demonstrate the relationship between work-related factors and health problems, but most do not estimate the work-related fraction of a particular type of health problem. Nevertheless, the few studies that do estimate the work-related fraction could help us in the estimation of the number of cases of work-related ill-health. In short, we could estimate the number of cases with regard to work-related health problems through:

- **registered occupational diseases** — national registries contain incident cases;
- **self-reported work-related health problems from surveys** — if respondents indicate that a relationship with their work exists, it is counted as a prevalent case;
- **the work-related fraction of a selection of diseases** — based on the registration of health problems in general and scientific studies on the percentage that is likely to be work-related.

Aside from the availability of data sources, all approaches have pros and cons (EU-OSHA, 2014). In this report we will examine the availability and the quality of all sources that may give us the information required for at least one of the approaches. Thus, we will examine registries of occupational diseases, self-reported work-related health problems and all diseases or health problems.

Presenteeism refers to the situation of being at work while feeling ill, resulting in productivity and output losses. Since presenteeism resulting in productivity loss is important in the cost estimation of poor OSH, we also examined the availability of data on this topic.

4.1.2 Methodology

International sources

To determine the quality of the data sources, we consulted websites, methodological reports and experts from our network. We also had personal communication with Eurostat to check our results on the availability and quality of their databases.

To visualise the quality at the European level per country, we used a three-point quality-score system. A score of 2 was assigned if all quality criteria were met, 1 if one or more of the criteria were not met, and 0 if no data were available. Our quality check contained at least three elements, namely coverage, latest year of availability and validity of the data. For each type of registration, slightly different criteria were used. Table 4 shows the allocation of scores.

Table 4: Allocation of quality scores per country with regard to the international sources

Category	Score = 2 if:	Score = 1 if:	Score = 0 if:
Accidents at work	▪ Sources available on fatal and non-fatal accidents ▪ No explicit bias in survey (*) or registration (**)	One or more is missing	Not available

Category	Score = 2 if:	Score = 1 if:	Score = 0 if:
	▪ Coverage should be comprehensive (***0 ▪ Latest year of availability after 2005		
Occupational diseases	▪ Sources available on fatal and non-fatal diseases ▪ No explicit bias in registration (**) ▪ Coverage should be comprehensive (***) ▪ Latest year of availability after 2005	One or more is missing	Not available
Work-related health problems	▪ No explicit bias in survey (*) ▪ Coverage should be comprehensive (***) ▪ Latest year of availability after 2005	One or more is missing	Not available
Presenteeism	▪ No explicit bias in survey (*) ▪ Coverage should be comprehensive (***) ▪ Latest year of availability after 2005	One or more is missing	Not available

(*) Representative, no extremely low response or other limitations.

(**) Not voluntary, no reports of underreporting.

(***) i.e. all sectors, all occupations and self-employed included.

National data sources

The quality check of the national data sources contained the same elements as the check of the international data sources. The same procedure was followed for the allocation of scores. However, as we did not have access to national sources on validity, we had to rely mostly on the information provided by the country experts via the templates.

4.1.3 Results

International data sources

Accidents at work

Four international data sources are available on accidents at work, two collected by Eurostat, one by the European Foundation for the Improvement of Living and Working Conditions (Eurofound) and one by the World Health Organization (WHO). The Eurostat sources on accidents at work are the European Statistics on Accidents at Work (ESAW) and the ad hoc modules of the EU Labour Force Survey (LFS-AHM) in 1999, 2007 and 2013 on 'accidents at work and other work related health problems'. The ESAW administrative data collection is based on notifications of accidents by employers and victims to the competent national authority or an accident insurer (except for the Netherlands, in which a survey is used) and includes only accidents that resulted in more than three days' absence from work (Eurostat, 2013). The LFS-AHM is based on surveys carried out in each EU country (separately) and has no restriction on days of absence. However, as it is a survey, it does not include fatal accidents.

Both sources use similar definitions of accidents at work. ESAW: 'a discrete occurrence in the course of work which leads to physical or mental harm. The phrase "in the course of work" means "while engaged in an occupational activity or during the time spent at work"' (Eurostat, 2013); LFS-AHM: 'a discrete and unforeseen event or occurrence which leads to physical harm to the respondent and that occurred at the workplace or in the course of work, i.e. whilst engaged in an occupational activity' (Agilis, 2015).

Another source is the European Working Conditions Survey (EWCS) administered by Eurofound. Although the survey is not intended to estimate the occurrence of accidents at work, it contains an interesting variable referring to the days of absence due to accidents at work (Gallup Europe, 2012; Parent-Thirion et al., 2012). Days of absence are important in cost calculation. Although the Eurostat databases also contain variables on days of absence, they are categorised (such as 'at least four days

but less than two weeks' and 'at least six months but less than nine months'), which hinders the estimation of costs.

In addition to the statistics on accidents mentioned above, the Health for All Database (HFA-DB), maintained by the WHO, also contains data on work-related accidents. The data are gathered from various sources (Health Information and Quality Authority, 2016). As the information from this database does not add to what we know from the other sources, and as less is known about the quality of these data, we will not consider them further.

Underreporting seems to be a large problem in reporting on accidents at work, in particular for the ESAW (Kurppa, 2015; Eurostat, 2016a). Underreporting refers to the situation in which employees and/or employers decide not to report an occupational accident or illness for a variety of reasons, or do not know they are obliged to report it. Barriers that result in underreporting are thought to include:

- lack of knowledge about the obligation to report or how to report;
- time required to obtain and complete the accident report forms;
- fear of negative consequences if a victim asks for medical absence from work in the event of a minor accident;
- fear of a negative influence on the reputation of the company;
- fear of consequences — more frequent inspections or requirements to invest more in safety and health measures;
- cultural reasons — in some societies minor accidents and health issues are regarded as insignificant and not worth bothering about.

Although in every country there is some sort of legal obligation to report accidents, a Eurostat report shows that underreporting is more common in countries without an insurance-based reporting system (Eurostat, 2016b). Insurance-based accident reporting systems often offer generous financial compensation for the victim when an accident is reported, as opposed to systems in which victims are covered by general social-security systems that do not distinguish between causes of the accident or disease.

A survey is not hindered by the same drawbacks as notification systems. Therefore, the LFS-AHM has the potential to give more insight into less severe accidents that result in sick leave of less than four days. However, surveys have their own drawbacks. In general, survey results are subject to recall bias (i.e. errors of judgement by respondents who may not know or remember all the details) and sampling error. Also, while Eurostat strives for harmonisation of data collection in all countries, national differences still occur. For example, the target population of the 2013 LFS-AHM consisted of all persons aged 15 or over, but small variations exist (Agilis, 2015). Furthermore, the evaluation of the questionnaires in 2007 as well as in 2013 highlighted some issues that may hinder cross-country comparisons (Venema et al., 2009; Agilis, 2015). Similarly to ESAW, in the LFS-AHM cultural aspects may also affect the reporting of accidents.

According to our scoring system for quality of data, as presented in Table 4, we could not allocate a high score (which would be 2) to any of the EU countries with regard to available data on accidents at work. The main reason is the alarming level of underreporting. Although underreporting differs among countries it seems to be a general problem, and it is unclear yet in which countries the reported figures are most reliable. Although for some countries figures on accidents at work are highly unreliable, we have not allocated a score of 0, which would indicate that no information is available. The reason for this is that we have figures on fatal accidents at work, which are assumed to be reasonably reliable as the seriousness of the event makes it difficult not to notify the appropriate authorities. For most countries, figures are also available from the LFS-AHM. Therefore, we concluded that data are available on accidents at work in EU countries, but the quality of such data cannot be guaranteed.

Occupational diseases

In 1995, Eurostat and the Directorate-General for Employment, Social Affairs and Inclusion started a pilot project to collect data on recognised cases of occupational diseases in the European Union. The European Occupational Diseases Statistics (EODS) project collects the number of newly recorded

cases of occupational diseases during the reference year. However, the concept of occupational disease is dependent on the national legislation and compensation practice (Eurostat, 2000). In 1998 the project was evaluated and the conclusion was that several factors impeded the comparability of data between countries. Factors that restricted the comparability were caused by differences in (Eurostat, 1999):

- definition of the reference population (e.g. inclusion of the self-employed);
- recognition of diseases, including differences in severity of the disease;
- coding of the medical diagnosis;
- method of data collection (e.g. by company physicians or by employers);
- degree of underreporting.

Still the value of statistical projects on safety and health was considered vital for monitoring of safety and health at work and the efficiency of regulation in this field. Therefore, a new project, EODS Phase 1, was launched including a new methodology. The aim was to obtain gradually harmonised, comparable and reliable data and indicators on occupational diseases (Eurostat, 2000). Unfortunately, the initial drawbacks of the EODS data collection remained. Also, the Member States were opposed to the dissemination of national data on Eurostat's website. In 2009 the EODS data collection ceased after a decision by the Health and Safety at Work Statistics Working Group, mainly because of problems in comparability (Stocks et al., 2015). The report of the European Commission on the situation, as of 2013, concluded that the main barriers to successful data collection were (European Commission, 2013):

- great heterogeneity in the systems for compensation of occupational diseases;
- great diversity of recording systems;
- underreporting;
- considerable variation in reliability.

The HFA-DB contains data on occupational diseases. However, little is known about the quality of these data. It is not even known which diseases are included as the database only contains the total number of occupational diseases. In response to a request for more information, a spokesperson of the WHO Regional Office for Europe confirmed that the comparability of data is very limited and it is understood that national definitions and registration practices vary significantly.

New initiatives have been undertaken to improve data collection on occupational diseases (Carder et al., 2015; Stocks et al., 2015). However, we conclude that, for now, no suitable data are available on occupational diseases in Europe.

Work-related health problems

Two international data sources are available on work-related health problems: the aforementioned LFS-AHM from 1999, 2007 and 2013 on 'accidents at work and other work related health problems' and the EWCS, which was conducted every five years from 1990 until 2015. The surveys used different approaches. The LFS-AHM refers to 'work-related health problems' defined as 'illnesses, disabilities or other physical or psychic health problems, apart from accidental injuries, suffered by the person during the past 12 months, that were caused or made worse by work'. Respondents were asked if they suffered from such a health problem, the most serious type of complaint caused or made worse by work, whether this serious complaint limited the ability to carry out normal day-to-day activities and how many days off work were caused by this health problem (Eurostat, 2010). The question on days of absence has uneven answer categories, such as 'at least four days but less than two weeks' and 'at least six months but less than nine months' (Office of National Statistics (UK), 2014).

In the EWCS up until 2010, self-reported work-related health problems were measured by assessing whether or not work had an impact on health, and the way it affected health, by summing up several types of health problems. The sick days that resulted from work-related health problems were also queried (Eurostat, 2010). However, in 2010 the questionnaire was changed. In the 2010 and 2015 questionnaires, one question referred to the relationship between work and health: 'Does your work affect your health?' Answer categories were: 'Yes, mainly positively', 'Yes, mainly negatively' and 'No'.

In 2015 a question was also added on the number of days of absence due to accidents at work and health problems caused or made worse by work.

Using self-reported work-related health problems as an indicator of the work-related burden of disease has some drawbacks:

- Fatal work-related health shocks are excluded.
- Diseases with a long latency period are often not reported (they may occur only after retirement).
- The workers themselves might not be the right people to assess the work-relatedness of their health problem.

In addition to these drawbacks, both the LFS-AHM and EWCS have additional problems. The general methodological issues related to the use of the LFS-AHM have already been explained in the section on accidents at work above. In particular for work-related health problems, some countries had high non-response rates because an incorrect filter was used in defining the target population of the LFS (Agilis, 2015). In addition, wording problems could cause underreporting in some countries, for instance for mental health problems (Venema et al., 2009; Agilis, 2015).

No significant methodological problems were identified in the 2012 technical report of the EWCS (Gallup Europe, 2012). However, additional information on work-related health problems is limited. Only information on days of absence is available.

All EU Member States, Norway and Iceland are covered by the EWCS and nearly all these countries are covered by the LFS-AHM. In the quality assessment of the data sources, we were inclined to allocate a maximum score to all countries. In particular, the EWCS met all the requirements we set for high-quality data, namely that there was no explicit survey bias, there was good coverage, including the self-employed, and the most recent data available were from 2005 or later. However, as a result of the drawbacks of the estimation of the work-related burden of disease by survey data as discussed earlier, together with the limited information available on work-related health problems, we did not allocate a score of 2, but instead allocated a 1.

Presenteeism

It has been suggested that the productivity and output loss caused by presenteeism is higher than the loss caused by absenteeism (Johns, 2010). Therefore, it is important to include presenteeism in the estimation of the costs of occupational accidents and ill-health. However, most studies do not include these costs (EU-OSHA, 2014).

The only source of data on presenteeism in Europe is the EWCS. In this survey presenteeism is assessed by the question: 'Over the 12 past months did you work when you were sick?' If respondents answered 'yes', the number of working days was asked. The question gives insight into the days with production and output losses due to illnesses. As the EWCS also asks which health problems the participants experienced in the past 12 months, we may get an indication of the production and output loss associated with different health problems. However, participants could have multiple health problems, which will hinder the estimation. Moreover, no information is available on the work-relatedness of these health problems.

As all countries examined in this report are covered by the EWCS and all the criteria of the quality assessment were met, we allocated a maximum score to all countries. However, the information in the EWCS is still limited and other sources or assumptions to estimate the production loss due to work-related health problems are required.

All morbidity

Sources on all morbidity may be helpful to estimate the work-related burden of disease if the work-related fraction of these diseases is known. In the scientific literature, this fraction is estimated for only a limited number of diseases, which are presumed to have a relation to work. Two sources are available on all morbidity, the Global Burden of Disease (GBD) study, coordinated by the Institute for Health Metrics and Evaluation (IHME), and the HFA-DB administered by the WHO.

The GBD study contains data on all diseases classified in the GBD-cause classification of the WHO, for all WHO Member States, including the countries in the target population of the present study (Institute for Health Metrics and Evaluation, 2016; Vos et al., 2016). The GBD 2015 study made use of many datasets and the analysis required complex methodological approaches. It is outside the scope of the present study to discuss the methods of the GBD study. However, the usual limitations of data sources, such as underreporting, undercoverage and bias, seem to be well considered within the GBD study. Therefore, we conclude that data on morbidity are of sufficiently high quality for use in our analysis. However, to assess the work-related burden of diseases, we still need to know the work-related fraction of these diseases.

The HFA-DB, which is administered by the WHO, also contains information on the incidence of several diseases. However, most of these diseases do not have an association with work (rubella, mumps, diabetes). Other diseases in the database might have a work-related fraction, but they are classified into very broad categories, such as 'cancer' and 'mental disorders', which allow only very crude estimations. Moreover, the methodological quality of the data in the HFA-DB is unknown, as previously mentioned. Therefore, we conclude that, for the purposes of our study, this database does not add any value to the results of the GBD study.

National data sources

Accidents at work

All countries examined in this study record data on accidents at work, comprising data on fatal accidents and on non-fatal accidents. Sometimes data come from a single source and in other cases various sources co-exist. All countries have a registration system to record workplace accident data and some Member States periodically collect survey data among workers in addition to this.

Surveys and registries do not always cover all workers; often self-employed workers are excluded. Moreover, family workers, volunteers, migrant workers and expatriates are not always included. Like international sources, national sources experience difficulties with underreporting; these problems are probably worse in countries without an insurance-based reporting system. In a number of countries we found reports in which the level of underreporting was estimated (see Annex B).

The quality of the national sources on accidents at work is similar to that of the European sources. In some countries the maximum score of 2 was achieved. However, it should be noted that we are dependent on the information from the country experts. If they do not report shortcomings, such as underreporting or undercoverage, we have assumed for the purpose of the analysis that these factors are not an issue.

Occupational diseases

Data from national registries of occupational diseases suffer from the same shortcomings as the international data. Not only is the incomparability of the data an issue, but underreporting also seems to be a large problem. Therefore, we conclude that, for now, the available national data sources are not sufficient to reliably estimate the number of cases of occupational diseases.

Work-related health problems

In total, 13 countries collect data on work-related health problems in addition to their contribution to the LFS-AHM and the EWCS. These are mainly survey data, but a number of countries have an additional registration system for work-related health problems. For example, in Spain, insurance companies with support from the employer/self-employed notify the Social Security Institute about the 'non-traumatic pathologies' (*Patologías no traumáticas*). Non-traumatic pathologies are those diseases not included in the list of occupational diseases and which (1) are suffered by the worker as a consequence of carrying out their job duties or (2) have been aggravated as a consequence of carrying out their job duties (the worker had the disease before). Depending on the country there may be several sources of this kind of information.

Based on the information in the templates, it was not possible to compare the quality of the national sources objectively. Therefore, we allocated all countries with data sources a 1, and those without data sources a 0.

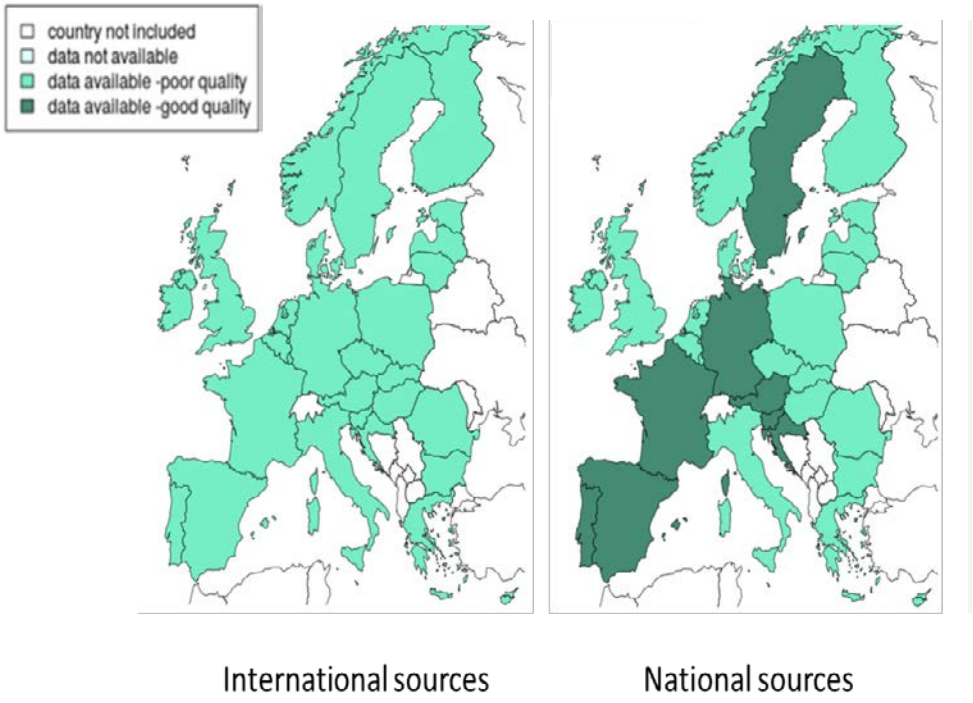
Presenteeism

Only eight countries have data sources related to presenteeism and the data are all derived from surveys. The UK has two surveys that contain questions on presenteeism. The quality in three of the eight countries seems to be satisfactory and they were allocated a 2. In other countries, quality is lower either because of a low response-rate or because self-employed persons are not included; they were allocated a 1.

Overview of results

Figure 1 shows the availability and quality of the international and national sources on occupational accidents. Although all countries are covered by the international sources, issues of accuracy exist. They may refer to undercoverage or underreporting. Although some countries have better quality data sources than others, all international sources had their shortcomings, which made it impossible to assign a high quality score to any of these sources. These shortcomings are detailed in Annex B. Nevertheless, national sources that might be of higher quality than the data gathered by Eurostat and Eurofound may be present.

Figure 1: Availability and quality of the international and national data sources on accidents at work.

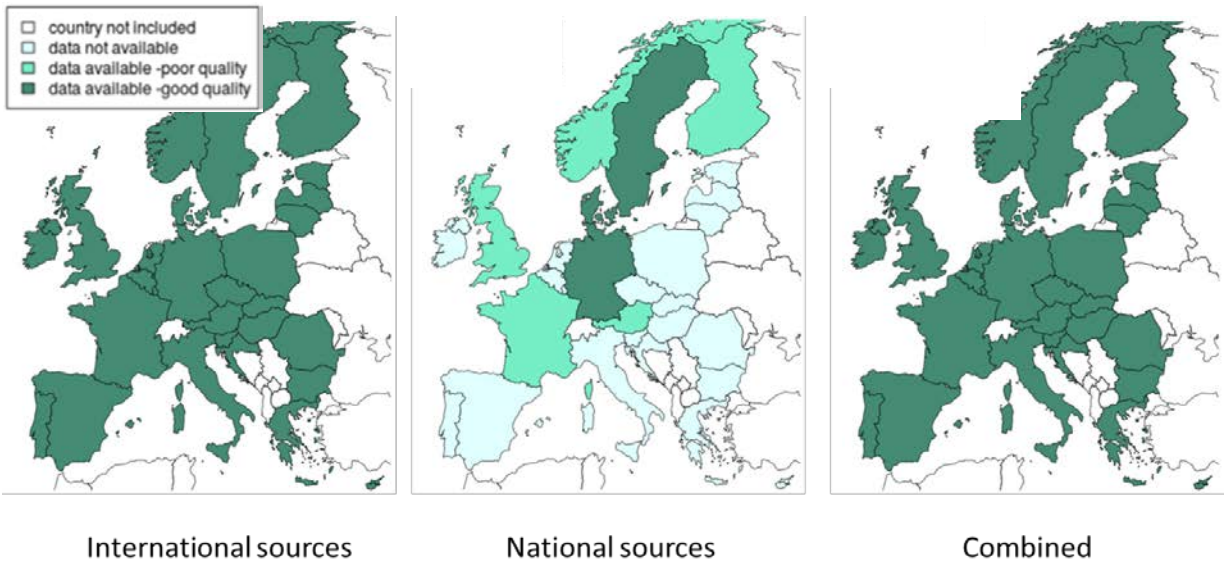


International sources on work-related health problems cover all countries included in this study; however, none of the countries have high-quality data available. This is not due to shortcomings of the national or international surveys, but is inherent to measuring the burden of work-related health problems by survey data, as explained in section 4.1.3, because of exclusion of fatal accidents and diseases with a long latency period, and the problem of assessing the relation of the illness to work. Annex C provides more detailed information on the data sources on work-related health problems.

Figure 2 shows the available data sources on presenteeism. The international data source is of high quality and covers all countries. In contrast to assessing work-related health problems, assessing presenteeism using surveys is appropriate. Nevertheless, the information we have on presenteeism

and the consequences it might have on costs is still limited, as the work-relatedness is still unknown. More information is provided on the data sources on presenteeism in Annex D.

Figure 2: Availability and quality of the international and national data sources on presenteeism.



Data on all morbidity (except for accidents at work, work-related health problems and presenteeism) are available for all participating countries. These data are available from an international source (GBD study) and are of high quality. No variance in quality between countries has been detected.

4.2 Costs

4.2.1 Cost types and categories

The primary step in the assessment of data sources for costs is the identification of essential cost categories. Therefore, all members of the Advisory Board were consulted and requested to stress, independently, the importance of all individual cost types in the original templates. In addition, scientific literature was examined and four broad categories were identified. Based on the comments of the Advisory Board, we decided not to include insurance costs as they are covered by the other categories. The following section provides insight into the composition of these categories.

Categories

First, the costs can be distinguished at two levels, namely (1) costs within or outside the healthcare system and (2) direct or indirect costs. Direct costs relate to elements of the care process, such as prevention, diagnosis, therapy, **rehabilitation** and care. Indirect costs arise as a secondary consequence of the disease or provided treatment. Combining these dichotomies results in four cost categories:

- direct costs within the healthcare system;
- direct costs outside the healthcare system (such as waiting and travel expenses);
- indirect costs within the healthcare system (such as costs of care in life-years gained); and
- indirect costs outside the healthcare system (such as loss of productivity).

In addition to direct and indirect costs, we distinguish costs related to the impact of work-related health problems on life. These costs refer to the value of loss in quality of life or to the loss of life itself. It is not possible to assign a monetary value to this loss directly. However, monetising quality-of-life losses is of great importance given their magnitude, as identified in earlier cost estimates.

Calculating costs

The calculation of direct costs is relatively straightforward. However, calculation of indirect costs and, more specifically, productivity losses is complex. The two most common ways to do so are the human capital approach and the friction cost method. Indirect costs using the human capital approach are estimated by multiplying the projected or measured number of **work days missed** by the estimated or measured **average daily income** (including employee benefits) of an individual. In the human capital approach it is assumed that wages are a proxy measure of worker output. The friction cost method, in contrast, is based on the assumption that the production costs depend on time required by the organisation to return to the initial production level. It is assumed that production losses are related to the time (**friction period**) needed to replace a sick worker. Therefore, based on the friction cost method, indirect costs will consist of the value of production losses and/or **extra costs to maintain production**, and/or, if permanent replacement is necessary, the **costs of recruitment** and training. These extra costs made to restore productivity levels are also known as opportunity costs.

Based on these findings, all relevant cost types were divided into four main categories (1) healthcare costs; (2) productivity costs; (3) additional costs; and (4) quality-of-life costs. Table 4 presents the individual cost types for each category.

Table 4. Individual cost types by category

Cost categories	Cost types
Healthcare costs	▪ Overall health spending ▪ Overall medical costs for workers in disability schemes
Productivity costs	▪ Gross salary ▪ Number of working days lost ▪ Friction period ▪ Overall costs of sick pay/sickness benefits ▪ Overall costs of incapacity/disability benefits
Additional costs	▪ Cost of temporary worker replacement ▪ Recruitment costs ▪ Rehabilitation costs
Quality-of-life costs	▪ Cost of quality of life ▪ Cost of life itself

4.2.2 Methodology

To determine the coverage of the data sources, we consulted websites, methodological reports and experts from our network. To visualise the coverage at the (inter)national level we used a dichotomous score. A score of 1 was assigned when a data source was available and a score of 0 when one was not.

4.2.3 Results

International data sources

At the European level, cost information was available for healthcare and productivity costs. Data for both categories can be found in different data sources, which are described below.

Healthcare costs

The international data sources contain information on overall health spending and overall medical costs for workers in disability schemes (indirect healthcare costs).

Two sources provide data on **overall health spending**, Eurostat and the OECD. The data from these sources were collected in the Joint OECD, Eurostat and WHO System of Health Accounts (SHA) Questionnaires [Joint Health Accounts Questionnaire (JHAQ)] from 2005 onward. Joint data collection was initiated to provide a global standard with regard to health data, making it more comparable and available, and to decrease the burden on countries of supplying statistical data to three different organisations. The original manual developed by the OECD, SHA 1.0 (OECD, 2000), was revised in 2011 with several additional questions as *A System of Health Accounts — 2011 Edition* (OECD et al., 2011). This SHA 2011 manual formed the basis of the JHAQ. Healthcare expenditure data are collected annually using this questionnaire; countries often use data from administrative sources and household surveys when completing the JHAQ (Eurostat, 2015a). The healthcare expenditure database contains information on total healthcare spending for each country. Although the SHA 2011 manual was developed to enhance the comparability and availability of health data, discrepancies between the data could still exist. The use of different sources (with different statistical approaches, surveys, availability and healthcare systems) can lead to differences in the quality (coverage, comparability, reliability and validity) of the data that are collected.

Data on **overall medical costs for workers in disability schemes** are provided by the OECD. The OECD has a database on public spending on incapacity, containing data on the public spending that results from sickness, occupational injuries and disabilities from 1980 onwards. This database is part of the OECD Social Expenditure Database (SOCX) (OECD, Retrieved November 2016b). The data in the SOCX database are quite comparable between countries and are judged to be reliable.

Productivity costs

Data on gross salary are provided by the Labour Cost Survey (LCS), which is used by Eurostat to collect data on labour costs in all Member States of the EU every four years (in 1996, 2000, 2004, 2008 and 2012). In every country, national statistical institutes collect their data using their own surveys, sometimes adding administrative data. All institutes base their samples on stratified random sampling techniques. These samples are stratified based on the size of the enterprise, economic activity and the geographical region of the enterprise. It covers enterprises with at least 10 employees in Nomenclature statistique des Activités économiques dans la Communauté Européenne (NACE)[8] sections B to S (excluding O — public administration and defence, compulsory social security). While the data are quite comparable between countries, it should be noted that a change in methodology could lead to decreased comparability over time and between countries. The data on gross salary are provided per year and a distinction is possible between part-time and full-time employees.

Additional costs

No international data sources contained data on the costs associated with temporary worker replacement, recruitment or rehabilitation.

Quality-of-life losses

No international data sources are known to have data on quality-adjusted life-years (QALYs). An alternative might be found in DALYs. DALYs are the sum of years lost as a result of premature mortality and years lived with disability, adjusted for severity (Lopez et al., 2006). Since 1990, the WHO has collected data on diseases in the GBD study. The DALY is the principal metric of the GBD study, as it enables decision-makers to compare the impact of different diseases (Institute for Health Metrics and Evaluation, 2016). Several methods exist to assign a monetary value to a DALY, depending on the approach to valuing a life. For instance, the human capital approach assigns a lower value than the approach using willingness to pay. An estimation sometimes used is a monetary value equal to average GDP per capita (Edwards, 2011).

[8] Nomenclature statistique des Activités économiques dans la Communauté Européenne.

In 2015, data were gathered for all diseases classified in the GBD-cause classification of the WHO, for all WHO Member States. Many health measures are included in the large database, among which the DALY is included, and the data are available by country (Institute for Health Metrics and Evaluation, 2016; Kassebaum et al., 2016). We concluded in the 'Quality-of-life losses' section that data from the GBD are of sufficiently high quality for use in our cost estimation.

National data sources

Healthcare costs

In total, 22 countries provided data sources on overall health spending. For overall medical costs for workers in disability schemes, only nine countries reported data sources.

Productivity costs

Looking at the individual cost types, almost all countries provided data sources on gross salary, overall costs of sick pay/sickness benefits and overall costs of incapacity/disability benefits. On the other hand, only five countries provided data on the friction period and the number of working days lost to sickness is available in just one country.

Additional costs

In total, six countries collected data on the costs of a temporary worker, recruitment and rehabilitation. Only two countries, Estonia and Finland, provided data sources for all cost types.

Quality-of-life losses

Limited information is available from national data sources. A study in Estonia estimated the willingness to pay for reductions in the risks of occupational injury. In the Netherlands, DALYs have been calculated for accidents at work and for a selection of diseases. In the United Kingdom a large study has estimated the willingness to pay to avoid the quality-of-life reductions associated with illnesses (Health and Safety Executive, 2011).

Overview of results

Figure 3 shows the coverage of the international and national data sources on healthcare costs. The set of healthcare costs includes overall health spending and overall medical costs for workers in disability schemes. By combining the international and national databases, the majority of the countries included in this study are covered, with the majority having high-quality data available.

Figure 3: Coverage of the international and national data sources for healthcare costs.

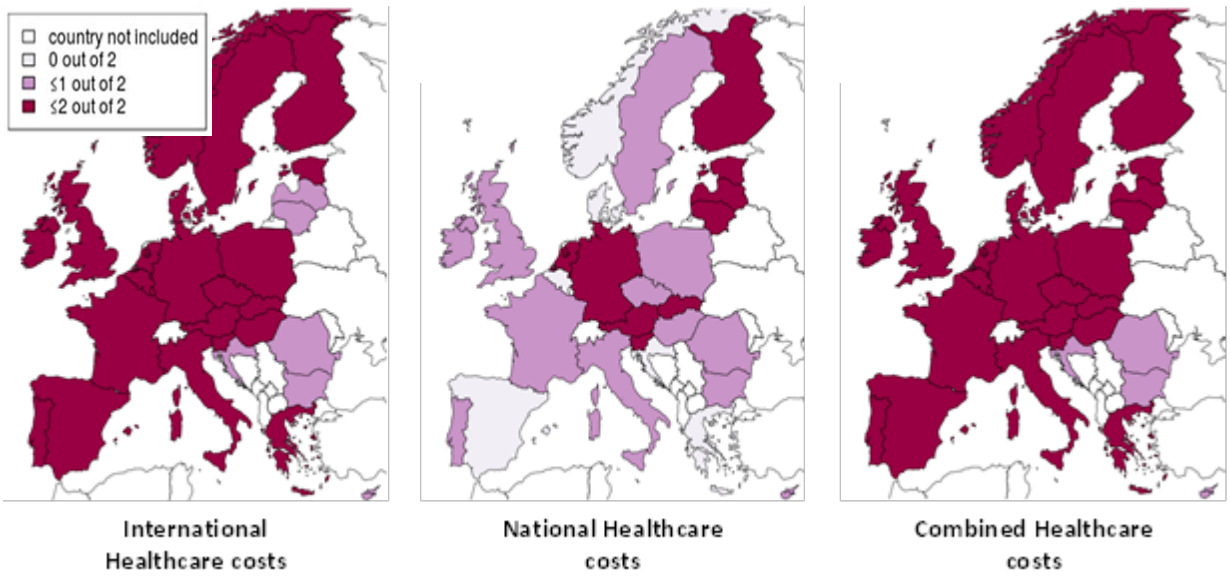


Figure 4 shows the coverage of the international and national data sources on productivity costs. The set of productivity costs includes **gross salary, number of working days lost, friction period, overall costs of sick pay/sickness benefits** and **overall costs of incapacity/disability benefits**. As shown, the coverage is fragmented; none of the countries have data sources that cover all five cost elements.

Figure 4: Coverage of the international and national data sources on productivity costs.

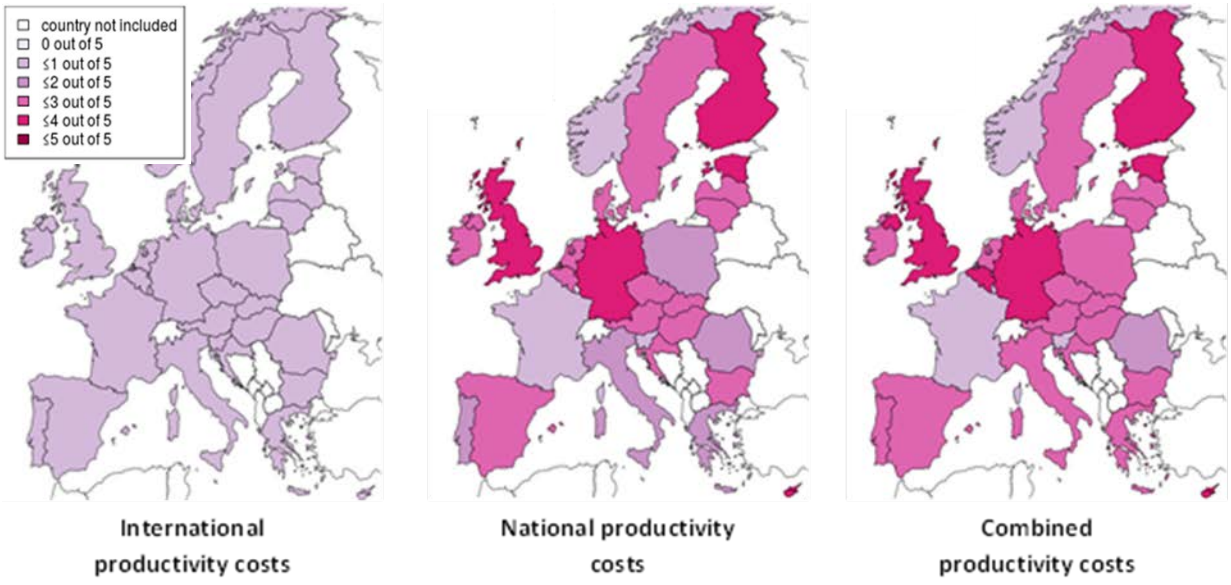
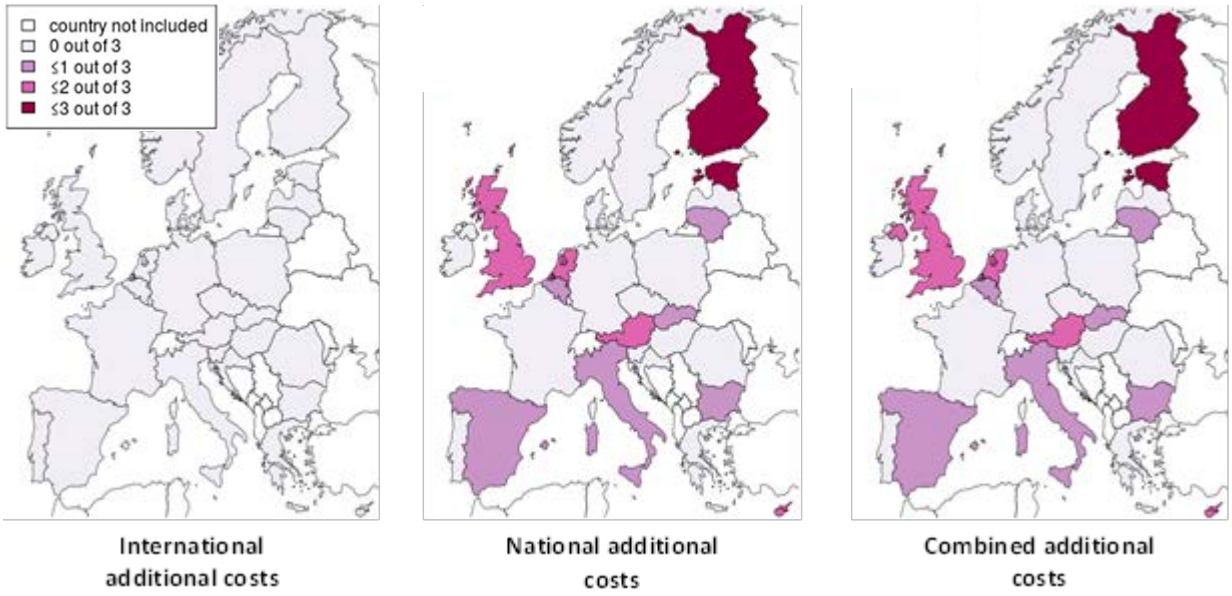


Figure 5 shows the coverage of the international and national sources on additional costs. The set of additional costs include **the costs of temporary worker replacement, recruitment and rehabilitation**. The lack of data on additional costs is apparent.

Figure 5: The availability of international and national data sources for additional costs



To tackle the costs of the impact of work-related health losses on life, data on DALYs are available. They can be retrieved from an international data source (the GBD study) and are of high quality. No variance of quality between countries has been detected.

5 Discussion of findings

5.1 Data gaps

A crucial step in the estimation of the costs of work-related health loss is the estimation of the number of accidents and incidents of ill-health caused or exacerbated by work.

- With regard to accidents at work, in the international data sources (ESAW and LFS-AHM) many countries had missing or unreliable data for non-fatal accidents. In some countries, national data sources are available that may complete or replace the international data sources; however, we cannot be sure of their quality.
- In addition to accidents at work, the occurrence of occupational diseases, defined as illnesses caused by work, is an important indicator of the work-related burden of disease. However, the debate on what diseases are caused by work and what diseases have another origin is ongoing. European countries apply different lists of occupational diseases.
- There are data available on work-related health problems for all European countries included in the present study. Although the data originate from sound international sources (surveys of high quality), the value of self-reported work-related health problems for estimating the work-related burden of disease is limited. The main reason for this is that fatal diseases and diseases with a long latency period cannot be picked up by self-report surveys.
- For all European countries we have figures on presenteeism that are derived from a high-quality survey. However, this information is not sufficient to estimate the productivity and output losses or any other costs that result from presenteeism.
- We have data on the prevalence and incidence of diseases, irrespective of their relation to work, for all European countries. However, to assess the work-related burden of diseases, we need to be able to estimate the work-related fraction of these diseases.

In summary, there were insufficient data to determine all cases of the work-related burden of disease at the European level. There is a paucity of robust, reliable data relating to accidents at work and work-related health problems. However, if we accept a large margin of error, it is possible to estimate the burden of disease, based on a number of assumptions.

Although data sources on cases are missing, we identified data sources for costs:

- The majority of countries provided data sources on overall health spending and overall medical costs for workers in disability schemes. To place the actual magnitude of healthcare costs in perspective, data on productivity costs and loss of quality of life are of great importance.
- With regard to productivity costs, international data sources provided data only on gross salary. National data on the number of working days lost, friction period, overall costs of sick pay/sickness benefits, overall costs of incapacity/disability benefits are fragmented, making the calculation of productivity costs challenging. The human capital approach — e.g. multiplying the number of work days missed by gross salary including employee benefits (see section 4.2.3) — seems the most appropriate means of calculating the cost of poor OSH practices, but this approach still requires the estimation of the number of work days missed because of work-related ill-health .
- Data on additional costs — mainly used for the friction cost approach — are rare. Therefore, extra costs made to replace a sick worker and reach the initial productivity level cannot be calculated.
- With regard to the quality-of-life losses, almost no data are available on QALYs or willingness to pay. An alternative may be found in the DALY. The GBD study provides information on DALYs for every EU and EEA country, and for 315 diseases and injuries. The work-related fraction is required to calculate the number of DALYs associated with accidents at work and work-related illness.

In summary, direct healthcare costs can be deduced from international data sources. However, calculating indirect costs is challenging, as several additional costs and costs on the friction period are missing. Based on the available data sources on gross salary, we recommend adopting the human capital approach. However, to use this approach, estimation of the number of work days missed is essential.

5.2 Validity of national data sources

To assess the national data sources on cases and costs, we consulted country experts. These experts were selected because of their knowledge in the field of OSH and the national structures concerning legislation, compensation, social protection, health care and health insurance. The experts signed a declaration of commitment and were approved by EU-OSHA. However, in undertaking their tasks for this project they may have been biased by their country-specific background. For example, in countries where the awareness of OSH issues is high, experts might be critical of the reliability of the national data sources. Also, reports on possible shortcomings of the registries, e.g. underreporting, will appear more frequently in high-awareness countries than in other countries. This phenomenon may have biased the results.

5.3 How to deal with missing or unreliable data

Given the complexity of the data required, it was expected that coverage of the cases and cost structures over all countries (EU-28, Iceland and Norway) would be incomplete. We foresaw this and collected data from national as well as international sources. However, the lack of data continues to obscure the overall picture. Several methods could be used to deal with these missing data. The main methods will be described in sections 5.3.1-5.3.3.

5.3.1 No data in specific countries

In sections 4.1.3 and 4.2.3, it was concluded that, for many countries, data on both costs and cases are missing. To get an overall picture of the costs of the work-related burden of disease, data from every country are required. We might consider estimating the costs of the missing countries by replacing some of the missing values with those measured in ‘similar’ countries. This approach is known as ‘hot deck’ imputation, where data from comparable countries are used as ‘donor units’ for the replacement of missing values.

This method allows the prediction of the most likely values using regression-based imputation methods, such as stochastic regression, whereby the average regression variance is added to the predicted value to induce natural residual variance.

To determine which countries are the most similar, one could compare them by the number of cases of work-related accidents and diseases. This assumes that the number of cases is mainly determined by the occupational risks in a certain country, and the occurrence of risks is mainly dependent on the type of industry in combination with the national OSH framework conditions to prevent these risks. Sufficient data are available on the type of industry per country. The quantity and quality of the effect of national OSH initiatives is harder to determine. However, some reports are available (EU-OSHA, 2016). A cost estimation could be based on these cases. This method of dealing with missing data is a ‘single imputation’ method and does not reflect the uncertainty created by missing data.

5.3.2 Multiple imputation

A more advanced way to deal with missing data is **multiple imputation.** Multiple imputation proceeds by imputing values for missing observations by methods comparable to stochastic regression. In this technique, the data from other informative data sources that are related to the number of cases and cost estimates can be optimally used along with the information from comparable countries. It uses the correlation structure between variables to generate a new, random value for the missing observation.

The aim is not to predict the missing observation, but to generate a plausible value that is consistent with the aim of the overall analysis. In multiple imputation analysis, this procedure is iterated to generate a set (often around five) of complete datasets, which are subsequently analysed and their results aggregated. Its feasibility in practice will depend on the associations between variables in the collected dataset, but this possibility can be explored ([9]).

The advantage of the multiple imputation method is that uncertainty over the missing values is taken into account, which will be reflected in the estimated number of cases and the costs at the EU level. The method is used not to predict a missing value for a specific country, but to obtain a robust overall estimate of incidents and costs for the EU. There is, however, a risk that countries differ too much in their economic structure to allow such generalisations. Therefore, the validity of imputation for missing data points needs to be evaluated and discussed.

5.3.3 Underreporting of accidents

Underreporting of accidents at work is a well-known problem, highlighted by many and described in several reports already (Eurostat, 2015b; Kurppa, 2015). Underreporting refers to the situation in which employees and/or employers decide not to report accidents or work-related diseases for a variety of reasons, or do not know they are obliged to report. Methods have been suggested to adjust the figures and to apply a correction factor. This might be based on the results from surveys in which the workers report the accidents themselves. A method that has been substantiated by research is to compare the ratio of fatal to non-fatal accidents. It is thought that the reporting of fatal accidents is more accurate. Research has also shown that, in countries where no underreporting is expected, the ratio of fatal to non-fatal accidents is stable (Kurppa, 2015). Therefore, the use of the fatal versus non-fatal accidents ratio might be a means to replace the unreliable data we have on non-fatal accidents at work.

There are several criteria that may contribute to underreporting. Insurance-based compensation systems, for example, may be more accurate than tax-based compensation systems because of certain reporting incentives, e.g. better medical treatment or compensation. In addition, some statistics are based on voluntary reporting of accidents. Further drivers of underreporting may relate to incentive systems at the enterprise level, e.g. promoting zero accidents, lack of compliance, lack of guidelines or unclear bureaucratic reporting regimes. Nevertheless, there appears to be no robust empirical evidence for the role these criteria play.

Other adjustments

Finally, other adjustments to the data aiming to enhance comparability can also be carried out at this point. In particular, the comparability of costs between different countries is unlikely to be representative at the monetary level. That is, the purchasing power of EUR 1 will differ across countries, so a representation in euros alone is not necessarily insightful. Therefore, potential conversion of monetary values into purchasing power could be explored at this point, with a view to arriving at a more comparable picture between countries.

5.4 Outlook and possible next steps

Given the lack of data, it may at first seem impossible to estimate the costs of the total work-related burden of disease in Europe at this point. However, having an overview of missing and available data, should it not be possible to estimate parts of it, or provide upper and lower boundaries for some countries, some diseases or some risk factors?

The overview of the results shows that sufficient data are not available in any of the European countries to estimate the exact work-related burden of disease or the cost of that burden. However, reality is more nuanced than we can show in the overviews of sections 4.1.3 and 4.2.3. In this project we collected

([9]) As a hypothetical example, consider the idea of calculating the total healthcare costs from available data on ambulance costs, costs of medication and information on the healthcare system, considering availability of information on the relationship between these variables from other countries.

information on which countries have data sources that will allow the estimation of the number of cases of work-related accidents or diseases and their associated costs, which is reasonably sound, although in each case some assumptions will still be necessary. Subsequently, these results may be used to estimate the costs in other countries with comparable structures.

A lot of work has already been done to estimate the work-related fraction of diseases such as hearing loss (Nelson et al., 2005), asthma (Blanc and Toren, 1999), chronic obstructive pulmonary disease (COPD) (Driscoll et al., 2005) and many more. The results of the GBD study were updated in 2016 and figures are available on the incidence and prevalence of more than 300 diseases and injuries (Vos et al., 2016). Figures might be available on the costs of these work-related diseases (healthcare costs, loss of productivity, etc.) allowing a cost estimation of the occupational burden of this specific disease. If this could be done for one disease in one country, then we could translate this to other countries or other diseases.

Another approach would be to use risk estimation. In this approach we could make use of existing research, as much work has already been done on the impact of certain risk factors on specific health problems, e.g. the EWCS (Parent-Thirion et al., 2012). The first step would be to estimate the country-specific exposure to these risk factors. An alternative method would be to estimate the exposure through the type of industries in a country. The next step would be to link health problems to costs. In this way, we could estimate the burden of disease caused by the specific type of risk. Of course, the list of occupational risks is long and their impact is not always known. Estimation of the **total** burden of work-related disease via risk estimation is still a long way off.

Finally, it is worth mentioning the efforts of the EU at the international level to harmonise the recognition of occupational diseases by providing guidance and instruments (European Commission, 2003). The need for harmonisation in occupational disease reporting was also stated in the EU-OSH Strategy 2007–2010 (European Commission, 2007). The European Commission continues to recognise the importance of collecting reliable data on work-related accidents and diseases, which it highlights in the 2014–2020 Strategic Framework. The following actions were planned to commence from 2014 (European Commission, 2014):

- assess the quality of data on accidents at work transmitted by Member States in the framework of the ESAW data collection, with the aim of improving coverage, reliability, comparability and timeliness → Commission and national competent authorities;
- by the end of 2016, examine different options to improve the availability and comparability of data on occupational diseases at the EU level and assess the feasibility of simplified data transmission → Commission and national competent authorities;
- launch discussions within the Advisory Committee on Safety and Health at work (ACSH), with advice from national experts, with a view to making recommendations on creating a common database on occupational exposure to accidents and disease → Commission, ACSH and national experts;
- before 2016, examine options to improve information on costs and benefits in the area of OSH; and
- before 2016, develop a tool to monitor the implementation of the EU Strategic Framework 2014–2020, including policy and performance indicators, building on the 2009 strategy scoreboard → Commission and ACSH.

In addition, a number of specific initiatives on the exchange of information (e.g. Modernet) can be reported (Modernet, 2016). Moreover, objective 6 of the 2014-2020 Strategic Framework specifically addresses the improvement needed for statistical data collection to provide better evidence and support the development of monitoring tools. The formal initiative by the EU Commission to improve the statistics for occupational disease, called OCCUSTAT, also fits in here.

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Annex A: Country profiles (summarised)

Country	Insurance system	Reporting system	Obligation	Incentives	Bonus–malus (if present) is based on
Austria	Predominantly Bismarckian	Insurance system	Employer	No insurance-based incentives	NA
Belgium	Predominantly Bismarckian	Insurance system	Employer	Bonus–malus system	Number and severity of accidents/size of company
Bulgaria	Predominantly Bismarckian	Insurance system	Employer/physician	Bonus–malus system	Economic activity/number of accidents
Croatia	Beveridgean and Bismarckian characteristics	Labour inspectorate	Employer	?	?
Cyprus	Predominantly Beveridgean	Labour inspectorate	Employer/physician	Bonus–malus system	Risk assessment of the company/number of accidents
Czech Republic	Predominantly Bismarckian	Labour inspectorate	Employer	Bonus–malus system	Principal activity/sector
Denmark	Predominantly Beveridgean	Labour inspectorate	Employer/employee	Bonus–malus system	Trade or industry of the company/category of risk
Estonia	Predominantly Bismarckian	Labour inspectorate	Employer	No insurance-based incentives	NA
Finland	Predominantly Beveridgean	Insurance system	Physician	Bonus–malus system	Accident rate/risk group of company (as determined by insurance)/size of company/type of work
France	Predominantly Bismarckian	Insurance system	Employee/employer	Bonus–malus system	Size of company/sector/accident and disease rate
Germany	Predominantly Bismarckian	Insurance system	Employer/physician	Bonus–malus system	Risks in business/annual wage sum

Country	Insurance system	Reporting system	Obligation	Incentives	Bonus–malus (if present) is based on
Greece	Predominantly Beveridgean	Insurance system	Employer/physician/employee	No insurance-based incentives	NA
Hungary	Predominantly Bismarckian	Labour inspectorate	Employer/physician	Bonus–malus system	Risks within the company
Iceland	Predominantly Beveridgean	Labour inspectorate	Employer	No insurance-based incentives	NA
Ireland	Predominantly Beveridgean	Labour inspectorate	Employer	No insurance-based incentives	NA
Italy	Predominantly Beveridgean	Insurance system	Employer	Bonus–malus system	Risk assessment/amount of salary
Latvia	Predominantly Bismarckian	Labour inspectorate	Employer/physician	No insurance-based incentives	NA
Lithuania	Predominantly Bismarckian	Labour inspectorate	Employer/employee	Bonus–malus system	Risk categories (as determined by insurance companies)
Luxembourg	Predominantly Bismarckian	Insurance system	Employer/employee/physician	No insurance-based incentives	NA
Malta	Predominantly Beveridgean	Labour inspectorate	Employee	No insurance-based incentives	NA
Netherlands	Predominantly Bismarckian	Labour inspectorate	Employer/physician	Additional insurance has bonus–malus system	Risks within company/prevention activities
Norway	Predominantly Beveridgean	Labour inspectorate	Employer	?	?
Poland	Predominantly Bismarckian	Labour inspectorate	Employee/employer/physician	Bonus–malus system	Size of enterprise/risks/consequences
Portugal	Predominantly Beveridgean	Insurance system	Employer	Bonus–malus system	Risk analysis/risk groups (as determined by insurance companies)/claim experience

Country	Insurance system	Reporting system	Obligation	Incentives	Bonus–malus (if present) is based on
Romania	Predominantly Bismarckian	Labour inspectorate	Employer	Bonus–malus system	Expenses incurred for prevention/risk category (as determined by insurance companies)
Slovakia	Beveridgean and Bismarckian characteristics	Labour inspectorate	Employer	Bonus–malus system	Risk categories (as determined by insurance companies)/safety and health records/promoting prevention
Slovenia	Predominantly Bismarckian	Labour inspectorate	Employer	No insurance-based incentives	NA
Spain	Predominantly Beveridgean	Insurance system	Employer	Bonus–malus system	Risk categories (as determined by insurance companies)/accident rates
Sweden	Predominantly Beveridgean	Labour inspectorate	Employer	No insurance-based incentives	NA
United Kingdom	Predominantly Beveridgean	Labour inspectorate	Employer	No insurance-based incentives	NA

NA = Not Applicable

? = unknown

Annex B: Accident data

International sources

Criteria	ESAW	LFS-AHM	HFA-DB
Validity	Undercoverage, underreporting of non-fatal accidents (all countries have registration data from insurance companies or labour inspectorates, but accident data for the Netherlands are based on a survey). Data on self-employed are voluntarily supplied	Survey data, which cover only accidents that occurred in the 12 months prior to the interview and do not include fatal accidents. The survey is based on a sample of the population, making the results subject to random sampling error. The survey includes the self-employed, volunteers, etc.	There are various sources from which WHO/Europe regularly collects health data. Some of the data are annually collected directly from countries. Some of the data come from WHO technical units that collect appropriate statistical information within their field; data on occupational accidents are available but the specific sources are unknown ([5])
Country coverage	All EU-countries participate, but see remarks on inclusion; a particular challenge of ESAW data is the accuracy of reference populations and incidence rates. Incidence rates often vary greatly between insurance-based and universal social security-based notification systems ([1])	The 2013 data includes all the EU-28 (except the Netherlands) and Norway, Switzerland and Turkey. The LFS-AHM 2007 covers the EU-27, Croatia, Iceland and Norway, but not Switzerland and Turkey ([3])	Non-fatal accidents: no data from 2006 onward were available for the UK; no data from 2007 onward were available for Bulgaria; no data from 2008 onward were available for Romania; no data from 2008 and 2009 were available for Spain. In 2014 no data were available for Finland, France, Greece, Ireland, Luxembourg and Portugal (or Bulgaria, Romania and the UK); in 2015 data were available only for Croatia, Spain and Estonia. Fatal accidents: same as accidents, but also no data in 2010, 2011 and 2013 for Spain ([6])
Coverage of diseases	Only accidents that result in > 3 days' sick leave are included; type of injury, body part injured and the severity of the accident are reported; variables on causes and circumstances of the accident are included ([1])	Accidents that result in < 4 days lost to sickness	Variables are: people injured due to work-related accidents per 100 000; the number of people injured due to work-related accidents; deaths due to work-related accidents per 100 000; and number of deaths due to work-related accidents ([6])

Criteria	ESAW	LFS-AHM	HFA-DB
Latest year of availability	2013	2013	2013/2014
Disaggregation potential	Age, gender, economic sector, occupation, type of employment, diagnosis	Age, gender, economic sector, occupation, type of employment	Age, gender
Remarks	☐ In the UK, accidents at work occurring in road traffic (during work) are not covered by the reporting system; it is thought that these accidents may account for about half of all fatal accidents at work ([1]) ☐ Data delivery for sectors T and U is voluntary; T = activities of households as employers and undifferentiated goods- and services-producing activities of households for own use; U = activities of extraterritorial organisations and bodies ([2]) ☐ Some sectors and professions are subject to confidentiality rules (e.g. defence activities, police inspectors) ([1]) ☐ Data from Germany and the Netherlands (all variables), Malta and Spain (variables on causes and circumstances) and Switzerland (some variables) and more recently from the UK (all variables) are based or partially based on sampling. Weighting procedures are applied in those countries to correct for sampling errors ([1])	☐ Sampling designs are chosen on a country-by-country basis (sampling rates vary between 0.2 % and 1.6 %). Most of the national statistics authorities employ multi-staged stratified random sample design, especially those that do not have central population registers available. As the results are based on a sample of the population they are subject to the usual types of errors associated with sampling techniques and interviews ([3]) ☐ Participation in the LFS-AHM 2013 was compulsory in nine of the participating countries, namely Belgium, Cyprus, France, Malta, Norway, Portugal, Slovakia, Spain and Turkey, while in the rest participation was voluntary. Greece did not mention in its quality report whether participation in the module was compulsory or voluntary ([4]) ☐ The 2013 LFS-AHM on accidents at work and other work-related health problems covered all persons aged 15 years or over. In four countries (Finland, Hungary, Latvia and Norway)	☐ The database includes data for all 51 (52 from 2004) WHO Member States in the European Region, although data availability and comparability may be limited for some countries ([7]) ☐ Cyprus: data refer to the population in government-controlled areas. The registration and coding of causes of death are incomplete ([8]) ☐ France: data refer to metropolitan France only. Data from overseas departments and territories of France can be found in databases of other WHO Regional Offices ([8]) ☐ Since recording and handling systems and practices for health data vary between countries, so do the availability and accuracy of data reported to the WHO. The comparability of data between countries is also limited, owing to differences in definitions and recording practices. Comparisons between countries and interpretations of them should be made with caution ([7])

Criteria	ESAW	LFS-AHM	HFA-DB
	☐ The Czech Republic, Denmark, Estonia, Hungary, Ireland, Italy, Norway and Sweden apply weights to correct for underreporting ([1]) ☐ Underreporting: data from Bulgaria, Latvia, Lithuania and Romania seem to include a higher degree of underreporting of non-fatal accidents at work (in 2012 their ratios of fatal to non-fatal accidents were between 14 and 55 times as high as the EU-28 average). Data from several other Member States may also be subject to underreporting, although to a lesser extent ([1]) ☐ A fatal accident at work is defined as an accident that leads to the death of a victim within one year of the accident. In practice the notification of an accident as fatal ranges from national registration procedures in which the accident is registered as fatal when the victim dies during the same day (Netherlands) or within 30 days of the accident (Germany) to cases where no time limits are laid down (Austria, Belgium, France — except for deaths occurring after the recognition of a permanent disability — Greece, Italy, Luxembourg, Norway and Sweden). For the other Member States the time limit is one year, except Spain, where the limit is 1.5 years after the date of the accident ([1])	The module was aimed at persons aged between 15 and 74 years, while in Spain persons aged 16 years or over were surveyed ([4]) ☐ Proxy use in the 2013 LFS-AHM, i.e. participation in the module via another person in the household, was allowed in 24 of 29 countries that participated in the module. The use of proxy interviews may impact on the accuracy of the results, as the questions in the module are mainly based on respondents' self-perception. In some countries proxy respondents could not provide answers to the questions addressed. The effect of proxy use on the accuracy of the results is an issue that requires further investigation ([4]) ☐ High rates of item non-response were observed in France (25.5 %), Hungary (37.4 %), Finland (21.3 %), the United Kingdom (9.0 %) and Norway (20.3 %) in what concerns the variable 'period off work because of the most serious health problem'. However, the filtering conditions used in the mentioned countries were not in line with the specifications, so potential respondents have been classified as non-respondents. Croatia (48.9 %) reported that respondents encountered difficulties in providing the required information ([4])	

(1) http://ec.europa.eu/eurostat/cache/metadata/en/hsw_acc_work_esms.htm

(2) http://ec.europa.eu/eurostat/statistics-explained/index.php/Accidents_at_work_statistics

(3) http://ec.europa.eu/eurostat/cache/metadata/en/hsw_apex_esms.htm

(4) http://ec.europa.eu/eurostat/documents/1978984/6037334/Evaluation_report_LFS_AHM_2013.7z

(5) https://www.hiqa.ie/healthcare/health-information/data-collections/online-catalogue/european-health-all-database-hfa-db

(6) http://data.euro.who.int/hfadb/

(7) https://euro.sharefile.com/d-sb7422ab51e54f20b (HFA-DB user manual

(8) http://data.euro.who.int/hfadb/help/Notes.htm

National sources

Country	Reliability	Fatal/non-fatal	Bias in survey or registration	Coverage	Latest year of availability
Austria	2	Both	Registration, no reports on underreporting	All	2014
Belgium	1	Both (fatal only in registration source)	Survey and registration sources	All, but self-employed not included in registration source	2013
Bulgaria	1	Both included	Only registration sources; reporting obligatory; no estimation of underreporting	National, but excluding self-employed, migrants, expatriates, students, volunteers, family helpers, trainees; no estimation of undercoverage	2013
Croatia	2	Both (fatal only in hzzsr source)	Statistical registration data (employer is obliged to report to hzzo, hzzzsr, labour inspectorate)	All	2014
Cyprus	1	Both	Statistical — registration; obliged to report	National, but excluding domestic servants, members of the police force, self-employed, family helpers, volunteers, trainees and expatriates	2014
Czech Republic	1	Both	Registration — obliged to report; there is an estimation of underreporting (not mentioned in template)	National, but excluding self-employed, family helpers, volunteers and expatriates; there is an estimation of undercoverage (not mentioned in template)	2014
Denmark	1	Both	Obligatory registration data; underreporting rate is given by the labour inspectorate with app 50 %; the underreporting varies between sectors and age groups, and depends particularly on the severity of the injury. The Danish Federation of Trade Unions concludes in its report on underreporting:	National, but excluding military service, work in private households of the employer, family members, expatriates and several types of volunteers	2014

Country	Reliability	Fatal/non-fatal	Bias in survey or registration	Coverage	Latest year of availability
			'Thus, for all major injuries resulting in at least one day's absence from work the best estimate of underreporting is likely to be around 30 percent.'		
Estonia	1	Both	Statistical sources; obligatory to report; there is an estimation of underreporting	National, but excluding self-employed, volunteers, family helpers, trainees, students, migrant workers, expatriates, workers without work agreements, intoxicated employees; 30 % of the workforce is not covered by statistics	2014
Finland	1	Both	Statistical report; obligatory reports; no estimation of underreporting	National, but excluding self-employed, volunteers, family helpers, trainees, students, migrants, expatriates	2016
France	2	Both	Obligatory reports; registration data; some estimation of underreporting (supposed to be close to zero)	All; some estimation of undercoverage	2013
Germany	2	Both	All data sources are statistical reports; reporting is obligatory; no estimation of underreporting	National, but excluding public servants with a special status of social benefits	2014
Greece	1	Both	All data sources are statistical reports; obligatory reports from employees and employers; due to economic recession and the high unemployment rate, workers can be pressed not to report accidents	Biggest data source is IKA: these statistics cover only workers insured by IKA (about 45 %), undeclared work is not covered. According to 'ARTEMIS' (a recording system used by three ministries for fighting undeclared work), during the last semester of 2015, undeclared work was found for 16 %. However some estimates suggest that 40-50 % of the working population participate in undeclared work; all sources, national but excluding, self-employed (sometimes), students;	2013

Country	Reliability	Fatal/non-fatal	Bias in survey or registration	Coverage	Latest year of availability
				volunteers trainees and expatriates were included if insured	
Hungary	1	Both	Statistical; obligatory registration; no estimation of underreporting	National (sector 84.2, self-employed, family helpers and students are excluded)	2015
Iceland	1	Both	Obligatory registration by employer (or insured person)	National, but with some exceptions according to Work Environment Act rules (see footnotes)	2014
Ireland	1	Both (fatal only in registration data)	Statistics (obligatory for employer to report) and survey (voluntary for employees to report) combined; estimation of underreporting available for statistical registration data	All, national but excluding expatriates and students; registration source — excluding defence forces on active duty, family helpers and members of the public; about 60 % of the workforce was not reported to this system in 2014; survey sources: unemployed workers and workers with no social insurance are excluded; no estimation of undercoverage	2014
Italy	1	Both	Statistical registration data; obligatory for employers	National, but excluding salespersons, journalists, airline personnel, firefighters, armed forces personnel, police officers, self-employed, volunteers, students, trainees, family helpers, migrants and expatriates	2015
Latvia	1	Both	Statistical report of obligatory registration by employer (employee can voluntarily report as well); underreporting of occupational accidents is estimated to be very significant — research suggests that only 10-20 % of accidents are registered	National, but excluding family helpers, volunteers, students, migrant workers and expatriates; general concern is that the proportion of workers in the 'grey economy' is somewhere between 20 % and 30 % —, these workers are automatically not included	2014

Country	Reliability	Fatal/non-fatal	Bias in survey or registration	Coverage	Latest year of availability
Lithuania	1	Both	Statistical registration data; reporting obligatory for employer and employee; no specific estimation of underreporting (see footnotes)	National, but excluding statutory workers, self-employed, family helpers, volunteers, trainees, students, expatriates and workers without a legal job contract	2014
Luxembourg	1	Both	Registration data; obligatory reporting for employer	National, but excluding state employees; only CNS covered	2011
Malta	1/0	Both (only number of fatal accidents reported, not accident rate)	Registration data; victims are obliged to report	Regional, but excluding family helpers, volunteers, trainees and students	2016
Netherlands	1	Both (from different sources)	Surveys and registration data (reports by hospital staff); estimation of underreporting is available for several sources	All, but not clear if expatriates are included; no estimation of undercoverage	2014
Norway	1	Fatalities not in report, but other sources: 44 fatalities in 2014 (http://www.arbeidstilsynet.no/nyhet.html?tid=250577), plus 17 more from the seafarers, petroleum and air traffic authorities, altogether 61 according to http://www.ssb.no/helse/statistikker/arbulykker	Registration data; reporting obligatory for employer, representatives of the employer, the insured person, the self-employed and the freelancer; no estimation of underreporting found in the official publication. There is a scientific article from 2003 comparing the number of persons treated for work-related accidents at two emergency stations (Legevakten and Ambulansetjenesten) in Oslo with the number of accidents registered as work-related recorded. The rate of accident reporting increased with the severity of the injury. The rate of accident reporting was 29 % for serious injuries (‘alvorlig’), 25 % for moderate injuries, 10 % for mild injuries and 13 % for all injuries	National, but partly excluding politicians and military personnel, who are treated with special rules	2014

Country	Reliability	Fatal/non-fatal	Bias in survey or registration	Coverage	Latest year of availability
Poland	1	Both	Statistics registration data; obligatory reports; no estimation of underreporting	National + agriculture in second source	2014
Portugal	2	Both	Combination of registration (obligatory) and survey (voluntary) reports (survey only among services and departments of the Ministry of Health)	GEP statistical source: fatal and non-fatal occupational accidents were recorded both for continental Portugal and for its autonomous regions. For non-fatal accidents on the continent and for the variables contained in the shares, a random sample was selected. The selection of the shares was made according to the systematic selection method. It was established a priori that the sample size would be one sixth of the total (accidents on the continent with no fatal consequences), which represents about 32,000 entries received in 2013. Survey data source: respondents were from the services and departments of the Ministério da Saúde (Ministry of Health). Respondents 93 % of the institutions in 2014 and 88 % of the institutions in 2013. Institutions not included in the survey: Centro de Medicina e de Reabilitação do Sul, Serviços Partilhados do Ministério da Saúde, EPE, Hospital de Cascais, Hospital Beatriz Ângelo — Loures; all: national, but volunteers and students excluded	2012/2013
Romania	1	Both	Statistics, registration; reporting obligatory for the employer or a person who has knowledge of a work-related accident; no estimation of underreporting	National, but excluding self-employed and family helpers; no estimation of undercoverage	2015

Country	Reliability	Fatal/non-fatal	Bias in survey or registration	Coverage	Latest year of availability
Slovakia	1	Both	Data from National Labour Inspectorate: reporting obligatory for employer; estimation of underreporting available — data from Social Insurance Agency; reporting obligatory for social insurance agency; no estimation of underreporting available	National, but excluding self-employed, volunteers, family helpers, students and trainees; no estimation of undercoverage	2014
Slovenia	2	Both	Statistical reports; reporting obligatory for employer; no estimation of underreporting	All; no estimation of undercoverage	2015
Spain	2	Both (fatal only in registration data)	For two surveys (part of the National Statistical Plan, so selected interviewees are obliged to respond); estimations of underreporting are given — for one source total sampling error is 1.06; for the other survey source sampling — confidence index of 95 %; statistical report (reporting obligatory for employer); no estimation of underreporting	All	2011
Sweden	2	Both	Statistical reports (for one source, reporting is obligatory for employer; for the other source, reporting is voluntary for employees); no estimations of underreporting	All	2015
United Kingdom	1	Both (but armed forces are excluded from registration data)	Survey (voluntary) and registration (obligatory) data; HSE says that RIDDOR data (registration data source) needs to be interpreted with care because it is known that non-fatal injuries are substantially underreported; estimation of underreporting available for both sources	National, but excluding family helpers, volunteers, students and expatriates; armed forces are excluded from registration source	2015

Notes:

Croatia: hzzo = Croatian Health Insurance Fund; hzzsr = Croatian Institute for Health Protection and Safety at Work

Denmark: Danish Federation of Trade Unions report (see: LO Underrapportering af arbejdsulykker, (Underreporting of work accidents, Copenhagen, April 2015, p8)

Greece: IKA is the largest Social Security Organisation in Greece. Merging of all insurance associations is planned. A new policy for standardising statistical reports and periodical publications for all insurance associations is development.

Hungary: There is no compulsory insurance for work-related accidents. However, when the employer's liability for the work accident is established, the labour inspectorate can impose a fine (if circumstances seriously endangered the life or health of the employee), and/or the National Health Insurance Fund can apply a payment order (to reimburse social security costs, e.g. expenses of health care/rehabilitation, sick pay). Thus the employer is counter-interested. On the other hand, the sick leave benefit for the employee is 100 % for occupational accidents and the healthcare-related to the accident is exempt from co-payment. Thus the employee can be motivated to report and officially register the accident.

Iceland: According to the legislation (Social Security Act, Art. 29): The following persons are insured against occupational injuries under this Section:

a. Wage-earners who work in Iceland, with the exception of foreign nationals who hold official positions for foreign states and the foreign staff of such officials. Work aboard an Icelandic vessel or aircraft, or a vessel or aircraft owned or operated by an Icelandic party, is equivalent to work in Iceland for the purpose of this indent, providing that wages are paid in Iceland.

b. Apprentices in legally protected industrial trades and students undergoing practical training in the health services and natural sciences, and university students when they are engaged in practical training.

c. Vessel owners who are themselves members of the crew.

d. Persons engaged in the rescue of people in mortal danger or in taking precautions against imminent serious damage to items of value.

e. Athletes (sportsmen) who participate in athletic activities, whether these take the form of training, exhibitions or competitions, and have reached the age of 16 years. The scope of this provision may be defined in further detail in regulations.

f. Employers in agriculture who engage in agricultural work, their spouses and their children aged between 13 and 17 years (inclusive).

g. Employers who work in their own businesses in occupational sectors other than those named in indent f.

An exemption may be granted from occupational injury insurance under indent of the first paragraph if the person concerned is demonstrably insured under foreign occupational injury insurance legislation.

All those who work in return for remuneration, without themselves being employers, whether in the form of hourly rates, fixed wages, share of fishing catch or payment for piece-work, are considered wage-earners.

Lithuania: The results of a survey performed by FIOH experts in Baltic countries suggest underreporting of minor accidents, and this figure exceeds 95 % or even 97 %; Kurppa K. Comparative work accident statistics in ten countries of the Baltic Sea Network on Occupational Health and Safety. (see references)

Luxembourg: Not publicly available.

Norway: Hans Magne Gravseth, Ebba Wergeland og Johan Lund: Underrapportering av arbeidsskader til Arbeidstilsynet, Tidsskrift for Den Norske Lægeforening nr 15, 2003.

Poland: All documents confirming occurrence of accidents at work have to be sent to CSO (Statistical Card of Accident at Work). Thus all registered cases are included in this publication (CSO source).

Portugal: GEP = Gabinete de Estratégia e Planeamento.

Slovakia: Neither source is publicly available.

Sweden: First source — data are based on reported accidents. Accidents not reported to the Social Insurance Agency are thus not part of the data. Second source — statistics are reported per year of the accident. There is also a delay to consider. Sometimes it might take several years before it is possible to see the full extent and ramifications of an accident or injury/disease.

Abbreviations: HSE, Health Service Executive; RIDDOR, Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013.

Annex C: Work-related diseases

International sources

Source	LFS-AHM	EWCS
Validity	Survey data; based on a sample of the population, makes the results subject to random sampling error; includes self-employed, volunteers, etc.	**Conducted every 5 years;** 1990-2015; a random sample of workers (employees and self-employed) is interviewed face to face (see remarks) **Sample size 2015**: in most countries the target sample size was 1000. The total sample size for the 6th EWCS in all 35 countries will be nearly 44,000 interviews ([1])
Country coverage	The 2013 data include all EU-28 Member States (except the Netherlands), Norway, Switzerland and Turkey. The LFS-AHM 2007 covered the EU-27, Croatia, Iceland and Norway, but not Switzerland or Turkey	EU and EFTA, except Iceland ([2])
Coverage of diseases	Covers the number of employed persons having had one or more work-related physical or mental health problem in the 12 months before the survey that were caused or made worse by work; covers the type of the most serious work-related health problem caused or made worse by work; in this survey, a work-related health problem covers all diseases, disabilities and other physical or mental health problems	**2005:** work-related health problems — does your work affect your health; how does it affect your health? **2010:** health problems were asked separately — does your work affect your health, or not? **2015:** Over the past 12 months how many days in total were you absent from work due to sick leave or health-related leave? How many of these days of absence resulted from health problems caused or made worse by your work (excluding accidents). Does your work affect your health?
Most recent year of availability	2013	2015
Disaggregation potential	Age, gender, economic sector, occupation, type of employment	Age, gender, economic sector, occupation, diagnosis (self-assessed)
Remarks	☐ Participation was compulsory in nine of the participating countries, namely Belgium, Cyprus, France, Malta, Norway, Portugal, Slovakia, Spain and Turkey, while in the rest participation was voluntary.	☐ 2015: multi-stage, stratified, random samples of the working population in each country were taken. Depending on the availability of high-quality registers, sampling was carried out using individual-level, household-level and address-level registers, or through enumeration using a random walk approach.

Source	LFS-AHM	EWCS
	Greece did not mention in its quality report whether participation in the module was compulsory or voluntary ([3]) ☐ The non-response rate for work-related health problems exceeded 30 % in Ireland, Lithuania, Luxembourg and the United Kingdom. These high non-response rates may be, to a large extent, attributed to the fact that an incorrect filter was used to define the target population. In detail, the population selected covered those who were working or had worked during the past 12 months (same target population as for the one on accidents at work), while persons who worked in the past and that should have been included in the target population were classified as non-responders. The high non-response rates recorded by the United Kingdom in the questions related to risk factors could be at least partially explained by the fact that proxy interviews were not allowed. In some countries the response rate was 100 %, which can be attributed to the fact that non-response was not permitted (i.e. the category 'cannot say' was not included at all) ([3]) ☐ 2013: 5 out of the 29 participating countries (Estonia, Latvia, Hungary, Luxembourg and Switzerland) asked not explicitly for 'mental health problems' but for 'illnesses', 'disabilities' or 'health problems'. Such wording variations may have resulted in an underestimation of the number of the reported health problems and may have also influenced the rest of the variables based on this concept. Additionally, Lithuania and Malta did not clarify that accidental injuries should not be included. This omission may have resulted in an overestimation of the number of the health problems.	☐ Country-level samples were stratified by region and degree of urbanisation. In each stratum, PSU were randomly selected proportional to size. Subsequently, a random sample of households was drawn in each PSU. Finally, unless individual-level registers were used, in each household the selected respondent was the person in work who would have their birthday next ([1]) ☐ Sample size: to reflect the larger size of the workforce in bigger countries, in 2015 the target was increased to 1,200 in Poland, 1,300 in Spain, 1,400 in Italy, 1,500 in France, 1,600 in the UK and 2,000 in Germany and Turkey. Eurofound also offered countries the opportunity to top up their sample. This offer was taken up by Belgium, Slovenia and Spain, which led to sample sizes of 2,500, 1,600 and 3,300, respectively, in these countries ([1]) ☐ 2010: the target sample size in most countries was 1,000. Exceptions were Germany and Turkey (target sample size of 2,000), and Italy, Poland and the United Kingdom (target sample size 1,500). Moreover, three countries decided to finance bigger national samples resulting in a target sample size of 4,000 in Belgium, 3,000 in France and 1,400 in Slovenia. The total number of interviews in 2010 was 43,816 ([4])

Source	LFS-AHM	EWCS
	☐ Regarding the type of the health problem, it should be highlighted that Bulgaria and Croatia used different wording for expressing 'headache and/or eyestrain', which has probably influenced the resulting figures. Additionally, Hungary added the answer category 'varicose' — it is unclear if that addition has affected the comparability of the results. Furthermore, four countries (Denmark, Cyprus, Italy and Malta) asked about 'normal' daily activities in the question regarding the health problem limiting daily activity, which has probably affected the resulting figures. Caution should also be taken when interpreting the data from the variable on the number of days of absence from work ('off work'), as 11 countries did not clarify that calendar days should be counted. Greek figures should be treated carefully, as the number of working days absent from work have been counted instead of calendar days ([3]) ☐ Bulgaria, Cyprus, Denmark and Ireland stated that proxy respondents had difficulties in providing concrete answers to the questions regarding the period of work absence ('off work'), the type of the work-related health problem and the risk factors affecting physical health or mental well-being. As stated in their quality and technical reports, proxy use may have affected the accuracy of the results. The opposite was stated by Slovakia ([3]) ☐ Bulgaria, Denmark, Hungary, Latvia and Slovakia reported that respondents could not easily specify the type of the most serious work-related health problem or determine the number of the health problems caused or made worse by work[3] ()	

Source	LFS-AHM	EWCS
	☐ The Czech Republic, Denmark, Italy and Slovakia raised the issue of the sensitivity of the information required. Respondents were not always willing to answer the questions regarding work-related health problems. Sweden also mentioned that some questions are subjective and therefore based only on respondents' perceptions ([3]) ☐ High item non-response rates were observed in France (25.5 %), Hungary (37.4 %), Finland (21.3 %), the United Kingdom (9.0 %) and Norway (20.3 %) in what concerns the variable 'period off work because of the most serious health problem'. However, the filtering conditions used in these countries were not in line with the specifications, so potential respondents have been classified as non-respondents. Croatia (48.9 %) reported that respondents encountered difficulties in providing the required information ([3])	

([1]) https://www.eurofound.europa.eu/sites/default/files/ef_survey/field_ef_documents/6th_ewcs_-_technical_report.pdf

([2]) http://www.eurofound.europa.eu/surveys/european-working-conditions-surveys

([3]) http://ec.europa.eu/eurostat/documents/1978984/6037334/Evaluation_report_LFS_AHM_2013.7z

([4]) http://www.eurofound.europa.eu/surveys/european-working-conditions-surveys/fifth-european-working-conditions-survey-2010/methodology

Abbreviations: IPA, Instrument for Pre-Accession Assistance; PSU, primary sampling units.

National sources

Country	Reliability	Bias in survey or registration	Coverage	Latest year of availability	Notes
Austria	1	Single study data	No data available on exclusion of sectors; self-employed not covered	2008	–
Belgium	0	–	–	–	–
Bulgaria	0	–	–	–	–
Croatia	0	–	–	–	–
Cyprus	1	–	Family helpers, volunteers, trainees and students excluded	2006	No absence days/severity info
Czech Republic	0	–		–	–
Denmark	1	–	Self-employed, family helpers, volunteers and expatriates are excluded	2012	–
Estonia	1	–	Self-employed (partly), volunteers, family helpers (partly), trainees, students, migrant workers and expatriates are excluded	2014	–
Finland	1	Registration data; obligatory reports	Self-employed, volunteers, family helpers, trainees, students, migrants and expatriates are excluded	2013	–
France	1	Surveillance programme among volunteer OPs	Self-employed, family helpers, volunteers, migrant workers, expatriates, trainees and students are excluded	Annually in several regions (2016), but latest national report published in 2012	Reports of WRD are rare although their notification is mandatory. The French Institute for Public Health Surveillance in collaboration with the Medical Occupational Inspection implemented a surveillance programme of WRD based on a network of

Country	Reliability	Bias in survey or registration	Coverage	Latest year of availability	Notes
					volunteer OPs
Germany	1	–	Public servants with a special status of social benefits and agricultural sector are excluded	2012	–
Greece	0	–	–	–	–
Hungary	0	–	–	–	–
Iceland	0	–	–	–	–
Ireland	1	–	Expatriates, students and unemployed workers are excluded	2015	–
Italy	0	–	–	–	–
Latvia	0	–	–	–	–
Lithuania	0	–	–	–	–
Luxembourg	0	–	–	–	–
Malta	0	–	–	–	–
Netherlands	1	Low response rate, in particular by self-employed	Family helpers, volunteers and expatriates are excluded	2014	
Norway	0	–	–	–	–
Poland	0	–	–	–	–
Portugal	0	–	–	–	–
Romania	0	–	–	–	The law expressly stipulates that WRD need not be reported. Only a few projects have researched them on a short timescale
Slovakia	0	–	–	–	–
Slovenia	0	–	–	–	–

Country	Reliability	Bias in survey or registration	Coverage	Latest year of availability	Notes
Spain	1	Register data and survey data	Register data — military/armed forces and volunteers are excluded; survey data — all included	2014	–
Sweden	1	No information available; no explicit bias	All	2014	The survey is conducted every other year with the aim of mapping health problems caused by work in the previous 12 months. The survey gives information on how many employees have experienced work-related problems during a certain period, on the anatomical location of the problem and on what may have caused it
United Kingdom	1	Survey and registration data (1 registration source has voluntary reports by GPs; the other registration data is from obligatory reports)	Family helpers, volunteers, students and expatriates are excluded; armed forces are excluded from both sources	2013	–

Abbreviations: GP, general practitioner; OP, occupational physician; WRD, work-related disease.

Annex D: Presenteeism

International sources

Source	EWCS
Validity	**Conducted every 5 years**; 1990-2015; a random sample of workers (employees and self-employed) is interviewed face to face; s**ample size 2015**: in most countries the target sample size was 1,000
Country coverage	**Sixth EWCS in 2015:** survey of workers in the EU-28, Albania, the former Yugoslav Republic of Macedonia, Montenegro, Norway, Serbia, Switzerland and Turkey; **fifth EWCS in 2010:** workers were surveyed in the EU-27, Albania, Croatia, Kosovo, the former Yugoslav Republic of Macedonia, Montenegro, Norway and Turkey; **fourth EWCS in 2005:** workers were surveyed in the EU-27, Croatia, Norway, Switzerland and Turkey; **third EWCS in 2000:** workers were surveyed in the EU-15 and Norway in a first phase, with the survey being extended in a second phase to cover the 12 new Member States in 2001, and Turkey in 2002; **second EWCS in 1995/1996:** workers in the EU-15 were surveyed; **first EWCS in 1990/1991**: workers in the EC-12 were surveyed
Coverage of diseases	Question: Over the past 12 months did you work when you were sick? (yes/no and number of working days)
Most recent year of availability	2015
Disaggregation potential	Age, m/f, economic sector, occupation, diagnosis (self-assessed)
Remarks	See references and remarks on the European Working Conditions Survey in Annex C

EC-12, 12 Member States of the European Communities.

National sources

Country	Reliability	Bias in survey or registration	Coverage	Latest year of availability	Notes
Austria	1	Single study using survey data; 31 % response rate	Only members of OÖGKK health insurance, regional data; excluding self-employed, volunteers, family helpers, trainees, students, migrant workers and expatriates	2014	Not publicly available
Belgium	0	–	–	–	–
Bulgaria	0	–	–	–	–
Croatia	0	–	–	–	–
Cyprus	0	–	–	–	–
Czech Republic	0	–	–	–	–
Denmark	2	–	Including self-employed; excluding family helpers, volunteers, students, trainees, migrants and expatriates	2008	–
Estonia	0	–	–	–	–
Finland	1	No information on how the data are collected; no explicit bias	Excluding self-employed, volunteers, family helpers, trainees, students, migrants and expatriates	2014	–
France	1	–	No information available on undercoverage or exclusion	2014	–
Germany	2	–	Excluding volunteers	2012	–
Greece	0	–	–	–	–
Hungary	0	–	–	–	–
Iceland	0	–	–	–	–

Country	Reliability	Bias in survey or registration	Coverage	Latest year of availability	Notes
Ireland	0	–	–	–	–
Italy	0	–	–	–	–
Latvia	0	–	–	–	–
Lithuania	0	–	–	–	–
Luxembourg	0	–	–	–	–
Malta	0	–	–	–	–
Netherlands	0	–	–	–	–
Norway	1	Low response rate	–	2011	–
Poland	0	–	–	–	–
Portugal	0	–	–	–	–
Romania	0	–	–	–	–
Slovakia	0	–	–	–	–
Slovenia	0	–	–	–	–
Spain	0	–	–	–	–
Sweden	2	No explicit bias	All	2013	–
United Kingdom	1	Data from two surveys; large response error for one source (CIPD)	Excluding self-employed, volunteers, family helpers, students, trainees, expatriates and migrants	2015	One of the two sources (Canada Life insurance) has little or no information available

Abbreviations: CIPD, Chartered Institute of Personnel and Development; OÖGKK, Oberösterreichische Gebietskrankenkasse.

Annex E: All morbidity

Source	GBD
Validity	Many datasets were used applying complex methodological approaches. No mention of methodological shortcomings that should be taken into account
Country coverage	All
Coverage of diseases	More than 300 diseases and injuries
Most recent year of availability	2015

Annex F: Costs

International sources

Source	LCS	Eurostat healthcare expenditure	OECD overall health spending	OECD overall medical costs for workers in disability schemes	GBD
Validity	Structural information on labour costs is collected through the 4-yearly LCS. In most cases, the data are collected by the national statistical institutes on the basis of stratified random samples of enterprises or local units, restricted in most countries to units with at least 10 employees. Member States have a legal obligation to carry out LCSs. Survey type varies by country and these vary from dedicated surveys to use of administrative data sources ([1])	Healthcare data on expenditure are largely based on surveys and administrative (register) data sources in the countries. Therefore, they reflect the country-specific way of organising health care and may not always be completely comparable ([2])	▪ The OCED overall health spending questionnaire is based on the same questionnaire as the Eurostat healthcare expenditure survey ([2])	Public spending on incapacity refers to spending due to sickness, disability and occupational injury, measured as a percentage of GDP ([5]) No reports are available on the quality of the data	The GBD Study aims to measure the impact of health problems on people. The principal metric is the DALY ([6]). Many datasets were used in the generation of these data, applying complex methodological approaches. No mention of methodological shortcomings that should be taken into account
Country coverage	LCS 2012: EU-28 Member States, Iceland, Macedonia, Norway, Serbia, Switzerland and Turkey ([1])	The area covered consists of the EU-27 (**excluding Greece, Ireland, Italy, Malta, and the United Kingdom**), Iceland and Norway ([2])	**Missing: Bulgaria, Croatia, Cyprus, Malta, Romania ([4])**	**Missing: Bulgaria, Croatia, Cyprus, Latvia, Lithuania, Malta, Romania ([5])**	All

Source	LCS	Eurostat healthcare expenditure	OECD overall health spending	OECD overall medical costs for workers in disability schemes	GBD
Coverage of costs	▪ Labour costs refer to the total expenditure borne by employers for the purpose of employing staff. They include employee compensation, which consists of gross wages and salaries in cash and in kind, employers' social security contributions, vocational training costs, other expenditure — such as recruitment costs and spending on working clothes — and employment taxes regarded as labour costs minus subsidies received ([1])	The International Classification for Health Accounts is followed ([2,3])	▪ The OCED overall health spending questionnaire is based on the same questionnaire as the Eurostat healthcare expenditure survey ([2])	Cash payments that result from complete or partial inability to participate gainfully in the labour market due to disability; cash spending on occupational injury and disease, such as paid sick leave, special allowances and disability-related payments (e.g. pensions and sickness benefits related to loss of earnings because of a temporary inability to work due to illness); services for the disabled — encompassing services such as day care and rehabilitation services, home-help services and other benefits in kind ([5])	No costs, only DALYs. The monetary value of these DALYs has yet to be established

Source	LCS	Eurostat healthcare expenditure	OECD overall health spending	OECD overall medical costs for workers in disability schemes	GBD
Most recent year of availability	2012	2014	2015	2015	2015
Remarks	☐ The LCS applies to all activities in sections B to S (excluding section O) of NACE Revision 2 and represents all statistical units occupying 10 or more employees. The coverage of NACE section O and units with fewer than 10 employees is optional ([1]) ☐ The quality reports show that the LCSs were, to a large extent, carried out without serious problems with regard to NACE coverage or coverage of mandatory variables. For a few Member States, completeness was affected by a few variables related to apprentices.	☐ Some countries are unable to cover all providers of care (the inclusion of private providers seems particularly difficult) or are unable to cover all financing agents or all functions at the detailed level requested ([2]) ☐ The quality of the data is subject to the way in which healthcare provision is organised in countries, and which information is available to be collected by the respective institutions ([2]) ☐ Data for 2003-2010 are extracted from the 2012 SHA JHAQ and, at the time of dissemination, are not fully validated	☐ Website: http://www.oecd.org/els/health-systems/health-expenditure.htm	–	–

Source	LCS	Eurostat healthcare expenditure	OECD overall health spending	OECD overall medical costs for workers in disability schemes	GBD
	In some Member States, candidate countries or EFTA countries, the LCSs were in almost all cases carried out with enterprise as the statistical unit but with a NACE coverage going beyond the mandatory scope (e.g. NACE Revision 2 section A or O) and the coverage of enterprises with fewer than 10 employees ([1]) ☐ Comparability over time may be distorted by improved methodology at the national level over time (fdoi[1])	Therefore, they should be considered preliminary estimates and may be subject to refinement ([2])			

1 http://ec.europa.eu/eurostat/cache/metadata/en/lcs_r2_esms.htm

2 http://ec.europa.eu/eurostat/cache/metadata/en/hlth_sha11_esms.htm

3 https://circabc.europa.eu/sd/d/598bd3f5-faf3-4e5c-a844-66304c2d4b10/SHA%20Guidelines.pdf

4 http://www.oecd-ilibrary.org/social-issues-migration-health/data/oecd-health-statistics/system-of-health-accounts-health-expenditure-by-function_data-00349-en

5 https://data.oecd.org/socialexp/public-spending-on-incapacity.htm

6 http://www.healthdata.org/sites/default/files/files/images/news_release/2016/IHME_GBD2015.pdf

Abbreviations: EFTA, European Free Trade Association.

National sources

Country	Productivity costs					Healthcare costs		Extra costs			Life impact
	Gross salary	Number of working days lost	Friction period	Sickness benefits	Disability benefits	Overall health spending	Disability schemes	Temporary workers	Recruitment	Rehabilitation	DALYs or WTP
Austria	X	–	–	X	X	X	X	?	?	–	–
Belgium	?	–	X	?	?	?	–	–	X	–	–
Bulgaria	X	–	–	X	X	X	–	–	–	X	–
Croatia	X	–	–	X	X	–	–	–	–	–	–
Cyprus	X	–	X	X	X	X	–	X	X	–	–
Czech Republic	X	–	–	X	X	X	–	–	–	–	–
Denmark	X	–	–	X	X	–	–	–	–	–	–
Estonia	X	–	X	X	X	X	X	X	X	X	X
Finland	X	–	X	X	X	X	X	X	X	X	–
France	X	–	–	–	–	X	–	–	–	–	–
Germany	X	–	X	X	X	X	X	–	–	–	–
Greece	–	–	–	X	X	–	–	–	–	–	–
Hungary	X	–	–	X	X	X	–	–	–	–	–
Iceland	X	–	–	X	X	X	–	–	–	–	–
Ireland	X	–	–	X	X	X	–	–	–	–	–
Italy	?	–	–	X	X	X	–	X	–	–	–
Latvia	X	–	–	X	X	X	X	–	–	–	–
Lithuania	X	–	–	X	X	X	X	–	–	X	–
Luxembourg	?	?	?	?	?	?	?	?	?	?	–

Country	Productivity costs					Healthcare costs		Extra costs			Life impact
	Gross salary	Number of working days lost	Friction period	Sickness benefits	Disability benefits	Overall health spending	Disability schemes	Temporary workers	Recruitment	Rehabilitation	DALYs or WTP
Malta	?	?	?	?	?	?	?	?	?	?	–
Netherlands	X	–	–	X	X	X	X	–	X	X	X
Norway	X	–	–	–	–	–	–	–	–	–	–
Poland	–	–	–	X	X	X	–	–	–	–	–
Portugal	?	–	–	X	X	X	–	–	–	–	–
Romania	X	–	–	X	–	X	–	–	–	–	–
Slovakia	X	–	–	X	X	X	X	–	–	X	–
Slovenia	X	–	–	–	–	X	X	–	–	–	–
Spain	X	–	–	X	X	–	–	X	–	–	–
Sweden	X	–	–	X	X	X	–	–	–	–	–
United Kingdom	X	X	–	X	X	X	–	X	X	–	X

X = available, '-' = not available, ? = unknown.

WTP; willingness to pay.

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The European Agency for Safety and Health at Work (EU-OSHA) contributes to making Europe a safer, healthier and more productive place to work. The Agency researches, develops, and distributes reliable, balanced, and impartial safety and health information and organises pan-European awareness raising campaigns. Set up by the European Union in 1994 and based in Bilbao, Spain, the Agency brings together representatives from the European Commission, Member State governments, employers' and workers' organisations, as well as leading experts in each of the EU Member States and beyond.

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